ARMED FORCES CHEMICAL JOURNAL

JANUARY-FEBRUARY 1960

ARMED FORCES CHEMICAL ASSOCIATION

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WASHINGTON 6, D.C.

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The members of this Association, mindful of the vital importance to national defense of chemistry, allied sciences, and the arts derived from them, have joined together as a patriotic obligation to preserve the knowledge of, and interest in, national defense problems derived from wartime experience; to extend the knowledge of, and interest in, these problems; and to promote cooperative endeavor among its members, the Armed Services, and civilian organizations in applying science to the problems confronting the military services and other defense agencies, particularly, but not exclusively in fields related to chemical warfare. (From Art. II, AFCA Constitution.)

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POLICY

The fact that an article appears in this magazine does not indicate approval of the views expressed in it by any one other than the author. It is our policy to print articles on subjects of interest in order to stimulate thought and promote discussion; this regardless of the fact that some or all of the opinions advanced may be at variance with those held by the Armed Forces Chemical Association, National Officers, and the Editors. It is the responsibility of contributors, including advertisers, to obtain security clearance, as appropriate, of matter submitted for publication. Such clearance does not necessarily indicate indorsement of the material for factual accuracy or opinion by the clearing agency.

PHOTO CREDITS

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ADVERTISERS

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A. F. C. A. AFFAIRS

SURVEY OF A.F.C.A. AFFAIRS

President Clifford L. Sayre announced at the meeting of the Executive Committee, on December 14 last, that Col. Chenery Salmon of Boston, formerly President of the New England Chapter, had been appointed by him as chairman of a committee to survey and report upon the status of and future outlook for the Association.

The action taken was pursuant to a motion at the previous Executive Meeting. It reflected a feeling on the part of the members that an examination of the Association's objectives and policies to determine their timeliness and conformity with current national defense considerations was in order at this time.

It is understood that the committee, other members of which will be named by the chairman, will consider among other matters the activities and relationship of the chapters to National Headquarters, organization and administration, fiscal procedures and policies, as well as membership and publications.

General Sayre in making the announcement indicated that no specific date for a report by the committee was fixed. However, a desire was expressed for a report in time for review and consideration of the committee during its term of office, which will expire next May.

Suggestions for consideration of the Survey Committee are invited.

DR. MURPHY—A.F.C.A. RESOLUTIONS

The Executive Committee of A.F.C.A., at its regular monthly meeting in Washington, D.C., December 14, unanimously adopted the following Resolutions in respect to the death of Dr. Walter J. Murphy, who was Vice President of the Association and Chairman of its Committee on Publications:

WHEREAS, by his support of the Nation's chemists engaged in National Defense and his assistance to the Armed Forces in bringing to the Department of Defense the advice and skills of these chemists, Dr. Walter J. Murphy has contributed substantially to the National Security; now, therefore be it

RESOLVED, That the Executive Committee of the Armed Forces Chemical Association at its meeting held this 14th day of December 1959 desires to spread upon its minutes a statement of its keen realization of its professional loss of a Vice President, and also the personal loss of a friend who will be greatly missed, and be it further

RESOLVED, That it is the Committee's wish that its heartfelt sympathy be extended to the family of the deceased and that the family be presented a copy of this Resolution, and be it further

RESOLVED, That a copy of this Resolution be published in the Journal of the Association.

DR. WALTER J. MURPHY

Dr. Walter J. Murphy, editorial director of the Applied Publications of the American Chemical Society, a vice president of the Armed Forces Chemical Association and one of its former directors-at-large, died in a Washington, D.C. hospital on November 26. He had been ill for several weeks. Dr. Murphy was in his 60th year.

Born in Brooklyn, New York, on August 20, 1899, he attended Polytechnic Institute there and received a B.S. degree in chemistry in 1921. For some years thereafter he was employed in industry as a research engineer and also as sales engineer.

However, it was in the field of chemical journalism that Dr. Murphy made his mark. In 1930 he became managing editor of the magazine "Chemical Markets," and in 1942 he was selected by the American Chemical Society as successor to the late Harrison E. Howe in four of the Society's important editorial posts. At the time of his death he was editorial director of the Society's weekly, CHEMICAL AND ENGINEERING NEWS, in which his widely read editorials appeared regularly. The other publications under his editorial direction were INDUSTRIAL AND ENGINEERING CHEMISTRY, ANALYTICAL CHEMISTRY, and JOURNAL OF AGRICULTURE AND FOOD CHEMISTRY.

Among the most noteworthy accomplishments of Dr. Murphy were his services to the military establishment. Early in 1945 he was sent overseas by the Technical Industrial Intelligence Committee of the Joint Chiefs of Staff to participate in the investigation of German wartime chemical developements.

In 1946 he was assigned as a technical representative at the atomic bomb test at Bikini in the Pacific, and later became a member of the Atomic Energy Commission's Advisory Committee on Technological Information.

In 1947 Centre College of Kentucky awarded Dr. Murphy the honorary degree of Doctor of Science, on which occasion he delivered an address at the College on "The Scientist in a New Age."

An author and lecturer, as well as editor, Dr. Murphy became widely known both in this country and abroad for his work in the advancement of chemical science. He had travelled extensively and was a member of numerous scientific and professional societies. Among the numerous special honors awarded him was the Gold Medal of the American Institute of Chemists given to him in 1950 in recognition of his services to the chemical profession and his outstanding ability as a technical editor.

VICE PRESIDENT FOR PUBLICATIONS

Colonel John C. MacArthur USA (Ret), Editor of the Armed Forces Chemical Journal, at the meeting of the Executive Committee of A.F.C.A., in Washington, D.C., on December 14, 1959, was appointed Vice President of A.F.C.A. and Chairman of the Committee on Publications to fill the unexpired term of Dr. Walter J. Murphy, deceased.

COLONEL DONALD H. HALE

Colonel Donald H. Hale, 58, retired officer of the Army Chemical Corps, who was employed as Assistant to the Director of the Applied Physics Laboratory, Johns Hopkins University, Silver Springs, Maryland, was found dead in bed at his residence in Silver Spring on November 7, the victim of a heart attack.

Colonel Hale retired from active duty in 1956, having served on a number of important assignments. A native of Rumford, South Dakota, he obtained a B.S. degree in chemistry and mathematics at York College, Nebraska. Continuing his studies, he received a Master's degree in physics from the University of Nebraska in 1929, and in 1939 the degree of Ph.D was conferred upon him by the University of California.

Colonel Hale had combined a military career with that of scientist and teacher. He joined the Nebraska National Guard in 1924, and in May 1928 was commissioned 2nd Lieutenant in the Chemical Warfare Reserve. Called to active duty in 1940, his assignments in World War II included duty as Chief of Field Service Branch, Chemical Warfare School, and Chief, Chemical Committee of the Infantry School, Fort Benning, Georgia.

Returning to civil life in 1945, he was engaged as a research physicist in industry and later as research associate at Northwestern University.

Colonel Hale was recalled to active duty in 1947, was integrated in the Regular service, and became the first chief of the Radiological Defense Branch of the Chemical Corps School. Later he commanded Dugway Proving Ground. At the time of his retirement in 1956 he was commanding officer of the Chemical Warfare laboratories at Army Chemical Center, Maryland.

MR. ARTHUR M. MILLER

Mr. Arthur M. Miller, chemical engineer, formerly a Vice President of the Armed Forces Chemical Association and President of the Washington, D.C. Chapter, died on October 26, 1959, from a heart attack while at his desk at the International Finance Corporation, Washington, D. C. The Corporation is affiliated with the World Bank.

Mr. Miller joined the Corporation early in 1959 following his retirement from the Rohm & Haas Company, by which chemical concern he had been employed for some years, his last position having been the director of a subsidiary of the Company in Great Britain.

Mr. Miller, who was 65, was born in Rochester, N.Y. He held degrees from Harvard University and Massachusetts Institute of Technology. In World War I he served as field artillery officer in France. In 1933, having then extensive experience in the chemical engineering field, he was named Chief Chemical Engineer of the Tennessee Valley Authority. In that capacity, he was director of some 300 scientists engaged at the TVA research plant at Muscle Shoals, Alabama, and among other activities, supervised large-scale production there of ammonium nitrate fertilizer. He left TVA at the close of World War II and became assistant to the president of Rohm & Haas and served as the Company's Washington representative. Before his assignment to Great Britain, Mr. Miller organized and established the first Canadian facility of the Company in Tronto.

MR. FRANCIS WILLIAM DARNER

The Tennessee Corporation has announced the death of Mr. Francis William Darner, Washington Representative of that concern and long a member of the Washington Chapter of the Armed Forces Chemical Association.

Mr. Darner's death occurred on the 26th of last August. However, this issue of THE JOURNAL provides the first opportunity to publish this announcement..

PRESIDENT SAYRE IS RETIRED FROM ACTIVE STATUS IN RESERVE CORPS

Ceremonies honoring Brigadier General Clifford L. Sayre on the occasion of his retirement from the active Army Reserve were held at the Army Chemical Center, Maryland, on 13 November 1959.

General Sayre, president of the Armed Forces Chemical Association, is Director of Engineering, Chemical Division, of the Food Machinery and Chemical Corporation. At the time of his retirement, he was the senior Chemical Corps Reserve officer, First United States Army, New York.

The ceremonies in General Sayre's honor included a review of troops and a reception at the Officers' Club. Major General Marshall Stubbs, Chief Chemical Officer of the Army, accompanied General Sayre on the reviewing stand.

DALLAS CHAPTER HONORS IRVING

The Dallas Chapter presented a gift, consisting of a thermos bottle kit, to Mr. K. G. Irving, outgoing president of the Dallas Chapter, at a dinner in his honor on December 2 last.

It was noted that Mr. Irving had been active in the chapter since 1952 and had never missed a meeting.

A special feature of the evening was an address by Colonel R. Beverly Caldwell, who spoke on the subject of the "One Army Concept" and current Chemical Corps organization and activities.

R. L. MURRAY HONORED UPON HIS RETIREMENT FROM HOOKER

Mr. R. Lindley Murray was honored by officials of Hooker Chemical Corporation at a dinner on December 15 last in Niagra Falls marking his retirement from active management in the company after more than forty-three years of association. He will continue as chairman of the board until the next annual directors' meeting on March 9, 1960.

The dinner was attended by approximately one hundred corporate and division officers, plant managers,

AFCA AFFAIRS

(Continued from Page 3)

and other executive personnel from various company operations in all parts of the United States as well as Canada.

Mr. R .Wolcott Hooker, master of ceremonies and a senior vice president, told of long and happy association with Mr. Murray and outlined the company's growth under his leadership.

Other speakers were Mr. Thomas E. Moffitt, company president, and Mr. Bjarne Klaussen, a former company president who retired in 1957.

Mr. Murray started his career with Hooker in September 1916, as a research chemical engineer.

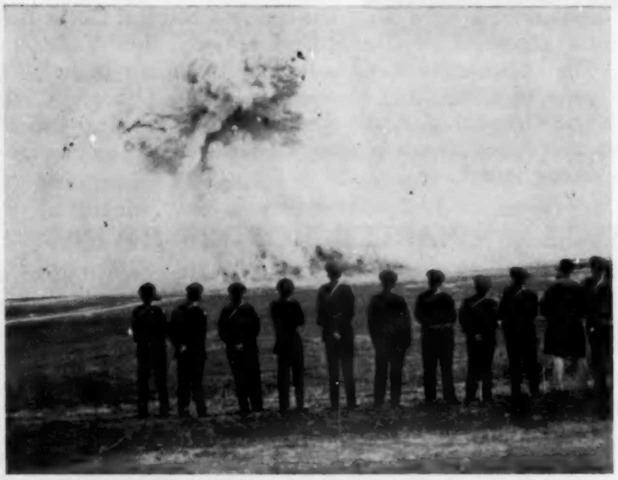
He has been plant superintendent, chief engineer, director of development and research, then executive vice president in 1949, and company president early in 1951.

Just before the end of World War II, as a special investigator for the Chemical Warfare Service, he was sent to Germany by the U. S. Government to survey the facilities and processes of German plants manufacturing military chemicals.

COLORADO SCHOOL OF MINES ROTC CADETS VISIT ROCKY MTN. ARSENAL

On Saturday, 21 November 1959, the Rocky Mountain Arsenal opened the gates for 45 officers and ROTC cadets from the Colorado School of Mines, Golden, Colorado. The officers and cadets were guests of the Rocky Mountain Chapter, Armed Forces Chemical Association.

The purpose of the tour was to give the officers and cadets an insight into the functions of the Chemical



Colorado Mining Engineering ROTC cadets view mass detonation of 500-lb incendiary bombs during visit to Rocky Mountain Arsenal, Denver, Colo.

Corps and the operation of a typical Chemical Corps installation under the Army Industrial Fund.

The program consisted of a series of orientations with Colonel William J. Allen, Jr., Arsenal commander, as keynote speaker.

* * *

Rocky Mountain Arsenal, Denver, Colorado, was host to the local community Little League football team, the Blue Devils, for their annual banquet on Thanksgiving Day at the Post Mess. Guest speaker, Doak Walker, the famous all-American football star, and recently elected to the Hall of Fame, gave a pep talk to the boys encouraging them in the continuance of the fine sport of football and praising them for their successful 1959 season.

Colonel William J. Allen, Jr., Commanding Officer of the Arsenal, was given a trophy by the Little League Team for his interest, cooperation and sponsorship of the team.

A.F.C.A. GATHERING AT McCLELLAN

The Fort McClellan, Alabama, Chapter of the Armed Forces Chemical Association held its first dinner meeting of the 1959-60 session on October 16 last.

At the Armed Forces Chemical Association Fort McClellan Chapter's dinner meeting. Standing, Col. John M. Palmer, commanding officer, U.S. Army Chemical Corps Training Command. Seated, (left to right) Mrs. Paul J. Walsh; Lt. Col. Howard C. Aylesworth, first vice-president; Mrs. Palmer; Col. Joseph S. Terrell, president; Mrs. Terrell; Lt. Col. Paul J. Walsh, second vice-president; and Mrs. Aylesworth.

The meeting was opened by Col. Joseph S. Terrell, commanding officer, U.S. Army Chemical Corps Field Requirements Agency, chapter president. He introduced Col. John M. Palmer, commanding officer, U.S. Army Chemical Corps Training Command, who spoke in his dual capacity as director-at-large, South Central area, A.F.C.A., and delegate to the national A.F.C.A. annual meeting held in Washington, D.C., September 10-11.

Col. Palmer's speech placed emphasis on the importance of the Association in furthering the Chemical Corps' mission. Pointing out how vital chemical, biological, and radiological warfare had become in national defense, he urged all professional officers to support the Association's aims in this area.

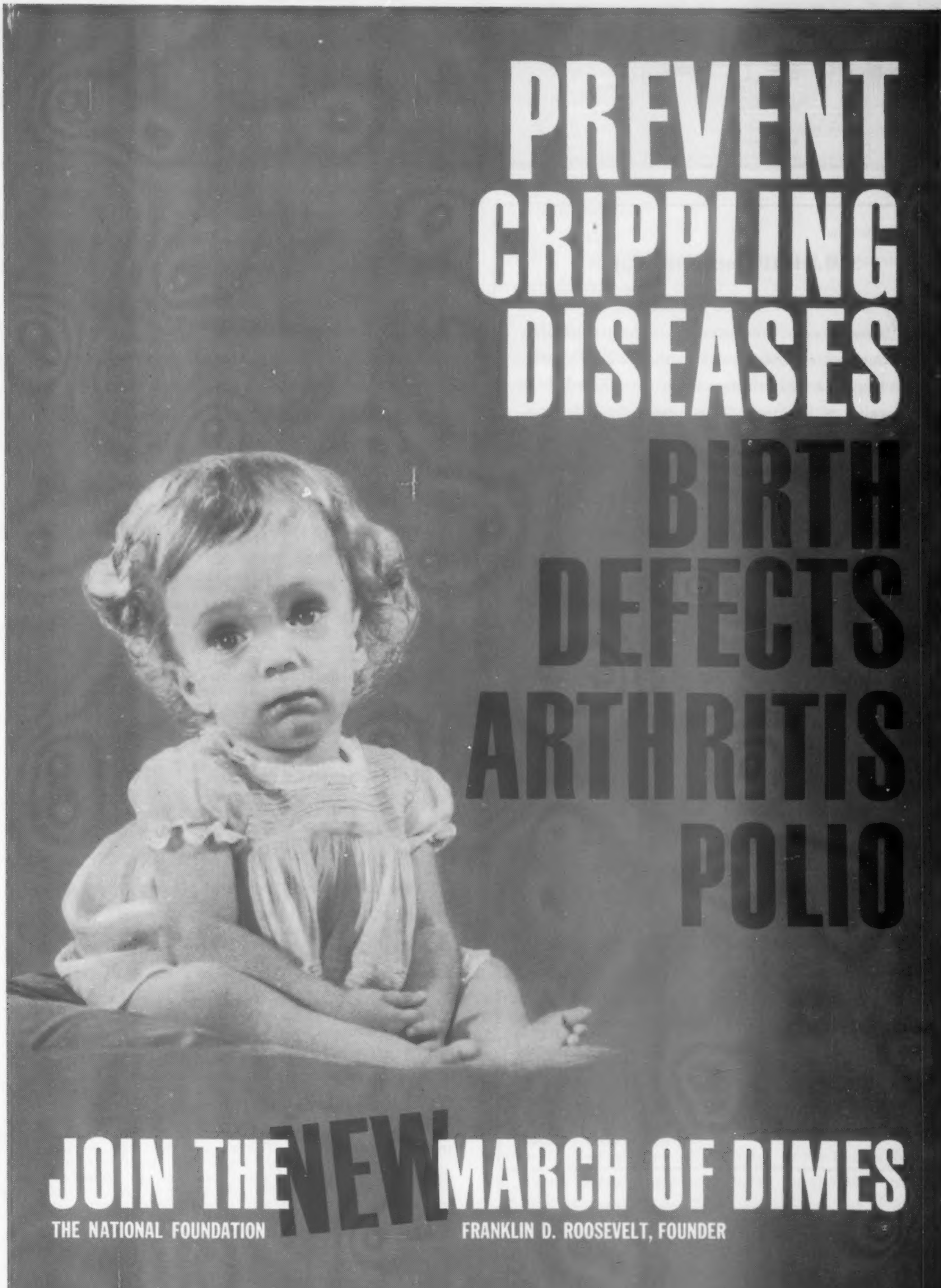
Also introduced at the meeting were the chapter's new officers for 1959-60 consisting of Lt. Col. Howard C. Aylesworth, first vice-president; Lt. Col. Paul J. Walsh, second vice-president; Mr. Douglas E. Wilson (Lt. Col. USAR) secretary-treasurer; Lt. Col. Joseph C. Hiett, Lt. Col. Norman I. Shapira, Maj. Gerald B. Hoover, First Lt. Charles G. Roberts, Mr. Richard C. Kneisel, Mr. Mitchell A. Modrall, directors.

* * *

An old-fashioned barbeque dinner, horseback rides for children, and an abundance of fun were part of the first 1959-60 gathering of the Fort McClellan Chapter of the Armed Forces Chemical Association.

The meeting, held 26 September 1959 at the U.S. Army Chemical Corps School Support Battalion picnic area, was attended by both civilians of the community and military personnel of Fort McClellan, their wives and children.

The high point of the day was horseback riding for the children, which was conducted by Lt. Colonel Stanton C. Huston and Major H. R. Jacobs. The horses were furnished by the George S. Patton Club of Fort McClellan.


PREVENT
CRIPPLING
DISEASES
BIRTH
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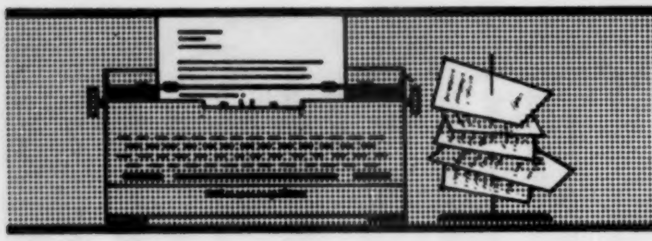
ARTHRITIS
POLIO
JOIN THE NEW MARCH OF DIMES
THE NATIONAL FOUNDATION
FRANKLIN D. ROOSEVELT, FOUNDER



FROM THE EDITOR'S NOTES

A.N.S. Release

SOLDIER—or Pushbutton?

WE must never be so beguiled by mechanical marvels and innovations as to forget that they are but tools of the ground combat soldier's trade.

It is quite easy in these times to be deluded about the value of this man. The phrases "missile warfare," "nuclear annihilation," "space wars," have inoculated some people with attitudes and conceptions of future warfare. These attitudes and concepts all but rule out the need of the combat soldier.

They would relegate him to the old corral along with the Cavalry horse or place him in the same category as the rapidly disappearing steam locomotive.

They are kidding themselves!

A realization has just begun to dawn. It is a gradual realization that the global, thermonuclear capabilities of nations to wage war could end in a stalemate.

If you will study the entire pattern of Communist aggression since the Cold War began, it has been one of stirring up local crises. And it wasn't a pushbutton that stopped them cold in their tracks. It was the ground combat soldier. He still is, as he always has been, the mailed fist of diplomacy —the warning hand against aggression.

It is no coincidence that in the history of the world, no battle for democracy was ever won without him. And history has a curious way of repeating itself.

—*General Bruce C. Clarke*

* * *

As General Marshall Saw It

The emphasis in military writing and speeches these days on the importance of the human factor in national defense—both qualitative and quantitative—makes especially pertinent the observations on this subject made by the late General George Catlett Marshall in his last biennial report to the Secretary of War as Chief of Staff of the Army.

In the introduction to this historic document which, as printed, bears his signature in facsimile and the date 1 September 1945, General Marshall includes a discussion of future technological possibilities for warfare that General Arnold, the Commanding General of the Army Air Forces, had prepared for him. Incidentally, it is remarkable how many of the developments envisioned by General Arnold—high speed, high altitude aircraft; long range rockets and missiles, etc.,—have now become realities.

However, it is not the pushbutton picture itself but rather the foresight and concern of General Marshall as to certain defense doctrines which he believed such developments would cause, that is of especial interest here. In that connection, General Marshall wrote:

"With the realization of these facts will also come a highly dangerous and attractive doctrine. It will be said that to protect itself this nation need only to rely on its machine power, that it will not need manpower.

"This doctrine will be closely akin to the doctrine of negative defense which destroyed France. The folly of the Maginot line was proved early in the war but too late to save France. The folly of the new doctrine which has already begun to take shape in the thinking of many Americans would also be proved early—but probably too late to save America.

"The only effective defense a nation can now maintain is the power of attack. And that power cannot be in machinery alone. There must be men to man the machines. And there must be men to come to close grips with the enemy and tear his operating bases and his productive establishment away from him before the war can end.

"The classic proof of this came in the battle of Britain. Even with the magnificent fighter defense of the Royal Air Force, even with the incredible efficiency

of the fire of thousands of antiaircraft guns, controlled and aimed by unerring electronic instruments, the British Islands remained under the fire of the German enemy until the final stages of the war.

"Not until the American and British armies crossed the channel and siezed control of the enemy's territory was the hail of rockets lifted from England. Not until we had physical possession of the launching sites and the factories that produced the V weapons did these attacks cease."

This report of General Marshall quoted here covers the period 1943-1945, and presents a brief but comprehensive resume of the operations of the war in all major theatres. It was published for the War Department in cooperation with the Council on Books in Wartime by the firm of Simon and Schuster.

* * *

Modern C-B Warfare Application

A short but comprehensive and impressive statement of the developments and major objectives of the Army Chemical Corps was presented by Major General Marshall Stubbs, Chief Chemical Officer of the Army, in an article in the January 1960 issue of *Army Information Digest*, the official U. S. Army magazine. The title of the article is "Invisible Weapons For the CBW Arsenal"—the CBW being short for Chemical and Biological Warfare. The Army Chemical Corps is referred to in the heading as "the research and development agency for all the U.S. Armed Forces in the Chemical and Biological field."

Interspersed in the article are quotations from several of General Stubbs' recent speeches, including addresses to New York and Wilmington chapters of the Armed Forces Chemical Association.

The subject matter generally has been covered in previous statements or writings, but some of the points made are especially noteworthy in respect to the applicability of CBW agents to battlefield conditions as currently envisioned. For instance, under the subheading "Tactical Use" General Stubbs states:

> *"Chemical and biological agents can be used to seek out the enemy whether widely dispersed or concentrated. They can be used in some situations to cause an enemy to mass or disperse, or to channel his movements.*
>
> *"Like the air itself, CBW agents can blanket the combat area even under the high dispersal conditions of future war. They can penetrate concealment or cover, including 'hardened' underground fortifications or installations. They can thus reach troops who are dug in or otherwise protected from high explosives or from the shock, thermal and radiation effects of nuclear weapons."*

Again, under the heading "Strategic Implications," General Stubbs states in part:

> *"CBW Munitions are not blind weapons of mass destruction. They can be used directly against troops without destroying military or industrial facilities.*
>
> *". . . They can be used alone, or in conjunction with conventional high explosive weapons, or with nuclear weapons, or in combinations of these weapons systems. . . ."*

In this article, General Stubbs states also: "United States plans must take into account the virtual certainty that CBW employment has a part in the war planning of other nations."

NEW BULLETIN URGES CIVIL DEFENSE SHELTERS FOR HOMES

The Federal Civil Defense Administration has announced publication of a technical bulletin to guide home owners, engineers, contractors and architects in planning family shelters against wartime levels of radioactive fallout.

It is stated that in the event of an enemy attack, fallout, drifting through the upper air miles from the point of explosion, could threaten every section of the United States. FCDA recommends that every family be prepared to protect itself from the dangerous effects of radiation that would result from a total attack. A proper family shelter would offer protection sufficient to reduce fallout's most significant hazard—gamma radiation—to a relatively harmless level.

The bulletin is entitled "Family Shelters for Protection Against Radioactive Fallout" (TB-5-3). It is available from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. for five cents per copy, or from FCDA, Battle Creek, Michigan.

THE U. S. ARMY CHEMICAL CORPS RADIOLOGICAL UNIT

An Army Approach to the Problem of Protection Against Radiation

Soldiers of Ft. McClellan Unit, wearing protective clothing and masks, operate radiac instruments in training exercise to determine the amount of radioactivity, if any, contained in their clothing and equipment following exposure.

By Major Fred E. Rosell, Jr., and SP4 Daniel J. Egan

U.S. Army Chemical Corps Training Command

During the field testing of nuclear devices, the protection of personnel against radioactivity is a major undertaking. To cope with the many safety requirements imposed by this activity and to provide systematic protection for personnel and equipment against radioactive contamination during field testing, the U.S. Army Chemical Corps organized in 1953 the U.S. Army First Radiological Safety Support Unit. This unit, which was recently redesignated the U.S. Army Chemical Corps Radiological Unit, is the only one of its type in the Armed Services.

The Rad Unit, as the unit is commonly called, is an organizational element of the U.S. Army Chemical Corps Training Command located at Fort McClellan, Alabama. While the unit is generally designed to provide radiological safety support for Joint Task Forces and the Defense Atomic Support Agency (formerly Armed Forces Special Weapons Project) at nuclear sites in the United States and the mid-Pacific area, it also assists in the radiological tests and other activities which aid in the development of training and tactical doctrine.

Staffed with twelve officers and seventy-five enlisted men, the Rad Unit is organized into a Unit Headquarters and three platoons—service, dosimetry, and operations (see Chart I). The Operations Platoon is further organized into three sections—monitoring, decontamination, and rad-chem laboratory; the Service Platoon is organized into two sections—instrument repair and supply. Because of its single function, the Dosimetry Platoon is not further subdivided. The Dosimetry Platoon and each of the sections of the other two platoons represent important functions in providing radiological

---

Major Rosell was commissioned in the Corps of Engineers in 1942, and served in that branch until 1956 when he was detailed in the Chemical Corps, transferring to that service in 1958. Before his present assignment as Nuclear Advisor, USA Chemical Corps Training Command, he had served with the USA Chemical Corps Field Requirements Agency, and as a Commanding Officer of the USA First Radiological Safety Support Unit, participating in radiological safety activities during the nuclear tests of Operations PLUMBBOB and HARDTACK. He is a graduate of the U.S. Military Academy, the Engineer School, the Airborne School, the Chemical Corps School, and the Command and General Staff College. He received an MS degree in civil engineering at California Institute of Technology and an MS degree in physics at the U.S. Naval Postgraduate School.

Sp4 Daniel J. Egan entered the Army in April 1957. A native of Pennsylvania, he attended the University of Detroit, majoring in Civil Engineering, prior to his entry on active serivce. During his tour of duty as a member of the U.S. Army First Radiological Safety Support Unit, he participated in radiological safety activities during the nuclear tests of Operations PLUMBBOB and HARDTACK.

(Continued on Page 10)

Scientists research constantly to improve or design new safety equipment . . .

Tool-makers, with experienced hands, skillfully manufacture production tools . . .

Inspectors, sharp-eyed and trained, check every component and each assembly . . .

Technicians assemble and test instruments to detect explosive and toxic atmospheres . . .

Machinists with precision tools shape metals to meet vital tolerances . . .

Millers and mixers process crude rubber to assure the quality of rubber products . . .

MSA taps a variety of special skills to meet the requirements of government projects

There's a well-established source of knowledge and skills available—at MSA—for carrying out government contracts in research, engineering and production.

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safety services to personnel engaged in nuclear weapons testing or other radiological activities.

Basic to any radiological safety system are the radiological detection instruments. At present, two principal types of these instruments are assigned to the Rad Unit; they are the AN/PDR 27, with probe, and the AN/PDR-39. The "27" meter will detect and compute gamma radiation, and will detect, but not compute, beta emissions. It is used primarily to monitor personnel. The "39" meter will detect, identify, and compute only gamma radiation and is especially designed for surveys of large surfaces, such as land areas, with readings being taken by monitors on foot or in surface transportation.

OTHER items essential to the operation of the Rad Unit are the personnel film badges, used to record individual radiation exposure, and film densitometers used in reading the exposed film badges to determine the specific number of roentgens to which the film and its wearer have been exposed. The latest model densitometers employ computing machines with memory units that record and store data secured from the film badges. The computing units have the capability of providing cumulative exposure data on personnel and units engaged in test operations.

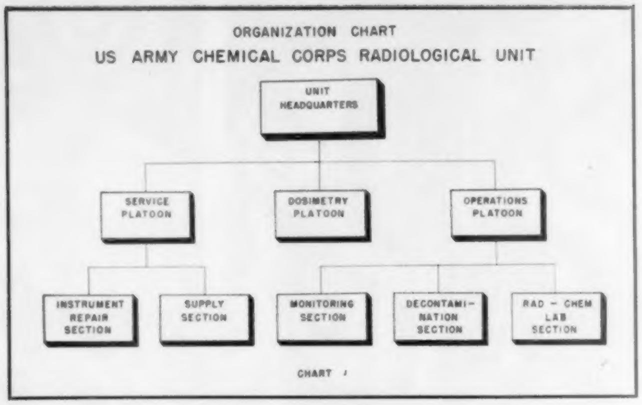
In conducting its operations at a test site, the Rad Unit establishes a standard radiological safety control and processing system applicable to all personnel working in areas subjected to induced radioactivity or appreciable fallout from a nuclear explosion. The system contains five elements: orientation of personnel, issuance of anti-contamination clothing and detection equipment, control of personnel entering and leaving a contaminated area, decontamination, and radiation exposure control.

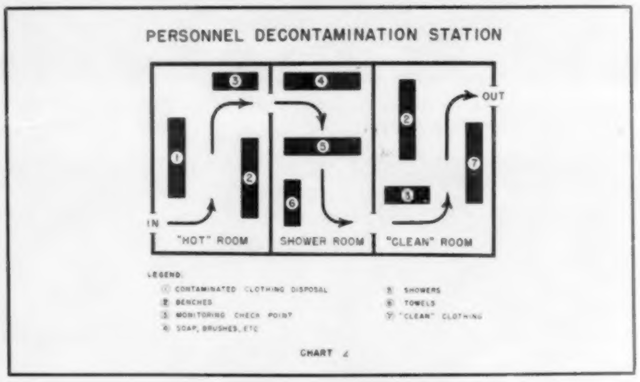
As a first step in this process, all personnel engaged in test work receive a safety orientation conducted by briefing officers of the Monitoring Section. At this orientation, the prevailing radiological situation, as established by aerial and ground surveys, is presented along with data covering the safety restrictions under which personnel must work. Following the orientation, personnel are issued required anti-contamination clothing, respirators, survey instruments, and film badges.

To control the movement of personnel and equipment in a contaminated area, radiation monitors from the Monitoring Platoon maintain check points at points of entry and departure. All personnel are logged in and out of the area, and departing personnel are instructed to report to a personnel decontamination station. At the time of departure, film badges are collected from personnel and sent to the Dosimetry Platoon for developing and analysis.

At the decontamination station (see Chart 2) personnel are required to remove anti-contamination clothing, and place it in containers located in the "hot" room. Personnel are then monitored to determine the extent of contamination, if any, and then shower to remove any radioactive residue. Showering is repeated as necessary until the individual is determined by monitoring to be free from contamination. Personnel are then issued clean clothing and released. In a similar procedure, equipment used in a contaminated area is processed through an equipment decontamination station and returned to normal use if possible.

THE Dosimetry Platoon, staffed with specialists in photographic laboratory procedures and film densitometer operations, are put to work developing the film packets. The film used is of the dental X-ray type,





and will record exposures to gamma radiation ranging from 0 to 600 or 1000 roentgens, depending on the actual type used. By using a densitometer with an automatic computer, several thousand film badges may be processed in a few hours and the results made available for timely exposure control of personnel.

Keeping the radiac survey instruments at an acceptable level of operation is the primary mission of the Instrument Repair section. In accomplishing its mission, this section establishes facilities for testing, repairing, and calibrating these instruments. The Supply Section maintains stocks of anti-contamination clothing, respirators, towels, and all other types of items required by the Rad Unit; in addition, it may operate facilities for laundering contaminated clothing.

The smallest section of the Rad Unit is the Rad-Chem Lab, which is primarily concerned with radioactive analysis of earth and water samples. It is staffed by four U.S. Navy personnel attached to the unit during test operations.

Although the work accomplished by the Rad Unit is demanding, the various nuclear test sites are organized to provide maximum recreation facilities for test personnel. The Pacific test sites—especially Eniwetok and Bikini Atolls—located in the Marshall Islands approximately 2500 miles southwest of Hawaii, have facilities for fishing, skin diving, skeet shooting, swimming, shell hunting, and many other activities, thus bridging the gap between work and recreation.

Though the Rad Unit performs its mission of radiological safety under relatively controlled conditions, the lessons learned by such operations have provided the U.S. Chemical Corps with many answers to the problem of radiological protection on the nuclear battlefield. The experience gained by the Rad Unit is continually subjected to testing and analysis by the U.S. Army Chemical Corps Training Command in its program to provide the combat arms and other services with the latest instruction and doctrine on radiological warfare, radiological defense, and radiological safety.

STATURE OF CHEMICAL CORPS NOW HIGHEST IN ITS HISTORY, RESERVE GROUP IS TOLD

"In any future war, one of the most important things for an individual may be his ability to recognize when he has been subjected to a psychochemical agent, and turn his job over to a trained replacement. When incapacitated by a psychochemical, a man's thinking is far from rational, although it may not seem so to him at the time."

Colonel L. E. Fellenz, Assistant Chief Chemical Officer for Planning and Doctrine, so told a group of Washington, D.C. reserve officers recently.

Speaking at the October dinner-meeting of Mobilization Designation Detachment No. 3 (Chemical), Colonel Fellenz related some of his experiences as a volunteer "guinea pig" with a psychochemical agent. Most of the members of the detachment hold mobilization designation assignments to the Office of the Chief Chemical Officer.

During his talk, Colonel Fellenz pointed out that the stature of the Chemical Corps is in an "unprecedented position—the highest in the Corps' history," and its role is being explored with increasing frequency at high-level national defense conferences. The role of the chemical agents has been enhanced greatly as a result of recent work in the Corps' laboratories with the psychochemicals, he said.

Colonel Fellenz used his own experience as an example of how a psychochemical agent attack could disrupt military operations without the incapacitated individuals realizing it. While he had volunteered for the test, the agent was given to him—in a cup of coffee—at a time he was least expecting it, just before a conference with a high-level officer who had been "tipped off" on what to expect. Colonel Fellenz said that while he thought he was thinking and talking rationally, it did not appear that way to his listener, and the situation could have been quite serious had it been anything other than a test of the agent's effects upon him. He pointed out that once a man has undergone such an experience he will recognize the symptoms in himself, and in others, in any subsequent attack, and noted further that, under such conditions, trained replacements must take over for the several hours it takes for the effects of the drugs to wear off, providing they are not similarly incapacitated.

Colonel Fellenz pointed out that such weapons as the psychochemical agents are also being developed by foreign powers. Their use in any future conflict is enhanced because of their ability to incapacitate without serious after-effects and the fact they do not create the destruction that would occur under nuclear war conditions.

The dinner-meeting was held at the Bolling Air Force Base Officers' Club.

—By Major Earle J. Townsend, U.S.A.R.

NEW POWER DRIVEN RESUSCITATOR MAY PROVIDE RESPIRATION FOR A DOZEN GAS CASES AT ONCE

EDGEWOOD, MD.,—A battlefield resuscitator which may allow a single Army aidman to supervise mechanical respiration for as many as a dozen nerve gas casualties at the same time has been designed in a joint project by the Army Medical Service and the Chemical Corps.

The apparatus was designed by Capt. Robert F. Hustead of the Army Medical Service and Dr. John Clements, an Army Chemical Center researcher. Captain Hustead—no longer in the Service—is now employed at Johns Hopkins Hospital in Baltimore.

Army researchers predict that the new "Edgewood Resuscitator", designed specifically for treatment of victims of severe nerve gas poisoning, may possibly also prove valuable in peacetime for the short term treatment of persons whose breathing is impaired from other causes. Use of the resuscitator would probably be limited to six hours per patient.

A number of individual resuscitators can be operated simultaneously from the same source of compressed air. In time of war, the unit would be suitable for use behind front lines, in aid stations, and in ambulances and helicopters evacuating the wounded.

The key feature of the apparatus which adapts it to nerve gas casualties is that it rhythmically delivers a set volume of air into the lungs of the victim, despite the resistance offered by the lungs of such a casualty.

The bronchial tubes of nerve gas casualties are usually tightly constricted, and considerable pressure is required to force in the life-giving air. As treatment gradually lessens the resistance, the Edgewood Resuscitator automatically adjusts the force behind the air as it is administered.

Conventional resuscitators would be inadequate to start treatment of severe nerve gas casualties, since such equipment usually does not generate sufficient pressure. In addition, they are generally unadaptable to a mass casualty situation.

Due to the tendency of the unconscious victim's throat to close, thereby shutting off the air supply, a patient to be left unattended for any length of time must have a tube inserted into his windpipe, assuring the unimpeded flow of air into the lungs.

According to Capt. Hustead, the Edgewood Resuscitator could be used by trained civilian rescue squads in reviving victims of drowning, electric shock, smoke poisoning, or other situations causing the respiratory system to fail.

The resuscitator is currently undergoing further development.

MULTI-PATIENT RESUSCITATOR—A masked aidman uses the new resuscitator to administer purified air to a gas casualty before removing him from the contaminated area. Aidman is administering the initial dose through an oronasal facepiece, while victim at left receives air through a plastic tube inserted in his windpipe. The resuscitator is powered by any source of compressed air, in this case the motor of the ambulance.

COMMERCIAL PLASTICS IN CHEMICAL WARFARE

Mr. Arthur Lyem (left) points out the new one-shot flame thrower and explains its method of operation to Major Robert W. Cornell. Mr. Lyem, chief of materials research for the Chemical Warfare Laboratories, is holding a plastic piston for another flame thrower that works by the same principle. Various other plastic items of the Army Chemical Corps comprise the rest of the display.

ARMY CHEMICAL CENTER, MD.—Accelerated research is paying off in greater use of plastics in chemical and biological warfare equipment, according to Mr. J. P. Mitchell, Director of Technical Services of the U.S. Army Chemical Warfare Laboratories.

Commercial plastics are under constant review, Mr. Mitchell pointed out recently. Properties sought in various plastics include light weight, flexibility, rigidity, transparency, selective impermeability to liquids and vapors, resistance to temperature and pressure, and nonreaction to chemical and biological agents. Low cost, in particular, is sought wherever it is compatible with quality.

A number of plastic items have resulted from this program so far. A vinyl piston for a new flame thrower is now being developed. Because it remains flexible at high pressures and extremes of temperature, the plastic piston does a job that no other substance can do.

An epoxy resin—fiberglass frontpiece for another, inexpensive, one-shot flame thrower, protects the nozzle against damage and accidental fouling.

A molded phenolic riot grenade is designed to prevent injuries from flying fragments when it bursts in a crowd and releases its tear gas. Like a baseball in size and shape, it can also be thrown farther and more accurately than the older type of grenade.

A speaking diaphragm for protective masks is made of the same plastic used for the strongest recording tapes. Less than one-twentieth of an inch thick, it permits easy conversation between wearers. Previously, the thickness of the diaphragm material muffled the voice.

A vinyl window has been developed for tank and helicopter protective masks. These masks require especially large, flexible windows. The plastic used is the same as that in the rear window of an automobile convertible top.

Polyester eye lenses are now being used in protective masks of all kinds. Formerly made of glass, the lenses had a high breakage rate, owing to the process of crimping them into their metal frames. With plastic, there is no breakage. Furthermore, the plastic lenses do not become fogged and are not readily scratched.

Plastics are also finding numerous uses in the laboratory and in packaging and storing, Mr. Mitchell pointed out. Unbreakable beakers reduce injuries that could lead to infection from biological agents. Plastic-lined tanks can store some bacteria that are neutralized by metal. A plastic foam is being used to pack such fragile items as glass tubing before shipping.

The field of plastics is not as far developed as the field of metallurgy, for example. Properties of plastics are not always well known, and in addition there is an almost infinite variety of possible plastics. Cooperation in research between industry and the Army is speeding progress in protection against chemical and biological warfare in this as well as in many other areas of both defense and commerce.

Plastic is ideally suited for the mass production of many objects. Complex shapes are easily molded from it and require little or no finishing. Sheet and film can be made as pliable as cloth or paper but transparent and repellent to chemical and biological agents. A cheap, mass-producible civilian protective mask, made of vinyl plastic, and a tent-like protector for infants and small children have both been approved recently.

Even in cases where plastics are not superior, Mr. Mitchell concluded, they can often be employed when other materials are not available or are in critical supply. Lightweight, generally indifferent to temperature and pressure, plastics have made products available today that would not be available for years if made from conventional materials.

"AS YOU WERE"

Basic Infantry men at Fort Dix, N.J., by removing masks in presence of tear gas in chamber, are quickly and effectively "sold" on the value of this protective equipment.

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MANAGEMENT OF THE CHEMICAL CORPS SUPPLY SYSTEM

By Captain Sampson H. Bass, Jr.
Headquarters, Chemical Corps Materiel Command

Since the successful firing of the Soviet Sputnik into outer space in the fall of 1957, the eyes of the people of the United States, and even the world, have been focused on the research and development activities of the military in Russia and this country. This increased interest resulted in raising the outlay of funds for military research to $3.5 billion in the fiscal year 1959. However, there is another phase of military activity, while not sharing the same limelight, that is equally as important. This is the effective support of the troops in the field. The research and development effort in a sense develops the items the soldier needs, but the supply effort completes the cycle by insuring that he gets the item where he needs it, when he needs it.

While timely and efficient supply of our forces is the objective of the Chemical Corps supply system, a major factor is getting the best results for the least defense dollars. This factor is particularly important when the size of the supply system is considered. Even though our operations are not as large as some of the other technical services in the Department of the Army, they are still great in relation to the supply activities of many large industrial corporations. For instance, in fiscal year 1959, the Chemical Corps will have spent approximately $7.5 million to operate its supply system. In addition, the value of the inventory is approximately $400 million (includes claimants' stock of other defense and non-defense agencies and departments), and over 600 persons are employed in this function. These figures are substantial evidence of the magnitude of the Chemical Corps' supply effort, particularly since the Chemical Corps' responsibility in this function includes the supply support of all military departments with chemical, biological, and radiological materiel.

ABOUT THE AUTHOR

Capt. Sampson H. Bass, Jr., at the time this article was written, was assigned to the Directorate of Supply Operations, Hqrs., U.S. Army Chemical Corps and Chemical Corps Materiel Command. He received his B.S. degree from V.M.I. in 1951 and MBA degree from the Graduate School of Business Administration, Harvard University, in 1957.

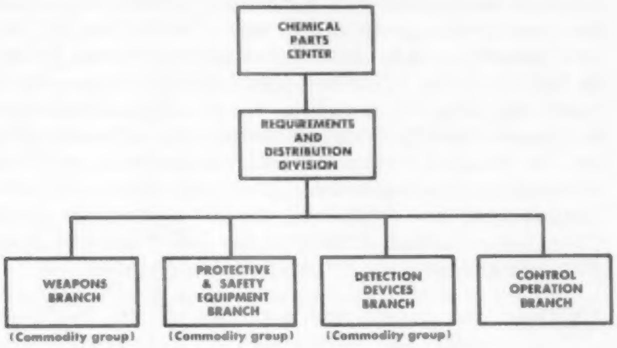
The size of the Chemical Corps supply system makes it imperative that it be properly managed. With more and more defense dollars being directed towards the research and development effort, the supply system's slice of the budgetary pie is becoming smaller. This, coupled with the requirement of adequately supporting our combat forces supply-wise, places a premium on economical operation with respect to manpower, materials, space, and funds. As an example, the reduction of 1% of our current inventory through more effective inventory management would release over $4 million for other uses, thus saving the Government around $120,000 annually based on the 3% interest that is paid on the national debt.

The responsibility for proper management of the Chemical Corps supply system has been assigned to the Commanding General, Chemical Corps Materiel

Loading Operation at the U. S. Army Chemical Depot, Eastern, Army Chemical Center, Maryland.

EXHIBIT 1

EXHIBIT 2



Command. This responsibility has been further delegated to a member of his staff, the Director for Supply Operations, whose staff supervises the receipt, storage, issue, maintenance, and disposal activities of the supply system. In addition, the Director for Supply Operations directly supervises the operation of the Chemical Corps National Inventory Control Point for End Items (which is an organizational segment of the Directorate for Supply Operations) and staff supervises the operation of the Chemical Corps National Inventory Control Point for Repair Parts, located at the Memphis General Depot, Memphis, Tennessee.

In performing his staff activities, the Director for Supply Operations implements and recommends modifications of policy for such important areas as depot activities, operation of maintenance facilities, and property disposal functions. Furthermore, these areas of effort are world-wide in scope. The depot activities of the Chemical Corps are performed in both Chemical Corps Branch Depots and in U.S. Army General Depots. The main difference between the two is that the branch depots are controlled by the Chemical Corps and handle Chemical Corps materiel exclusively, while general depots are administered by the Quartermaster General and handle the materiel of other technical services in addition to Chemical Corps materiel. In addition, depot maintenance activities of the Chemical Corps are performed at Chemical Corps Branch Depots while field maintenance is performed in Chemical Corps field maintenance shops located at numerous installations, some of which are not under Chemical Corps control. Moreover, maintenance efforts are not limited to this area alone. The Chemical Corps has a technical assistance program which is patterned to great extent after the technical representative selling technique widely used in industry. Regional maintenance representatives visit customers of the Chemical Corps to assist them in understanding the use and care of Chemical Corps materiel. This effort has paid great dividends by creating a more effective relationship between the customer and the Chemical Corps.

While depot and maintenance activities are essentially limited to Chemical Corps items of supply, the property disposal activities are taking on an Army-wide and even a Department of Defense-wide aspect. This important function not only involves the disposal of Chemical Corps items of issue but also the disposal of radioactive waste. With the increasing emphasis on the use of radioactive material, the disposal of radioactive wastes will undoubtedly increase many-fold. The Chemical Corps is now engaged in radiological waste disposal for the Army as a whole and consideration is being given to the extension of this responsibility to a Department of Defense-wide basis.

While many of the important staff functions performed by the Director for Supply Operations are long-range in nature, the day-to-day operational activities of the supply system have an important short-range aspect. If any weaknesses appear in these operational activities, the problems and difficulties that result will be immediately felt. Because of the direct operational control that the National Inventory Control Point (NICP) has over the proper management of the Chemical Corps supply system, considerable attention will be given toward discussing this important aspect of our overall supply operations.

The NICP for end items was established in July 1957 at Materiel Command headquarters. This organization is charged with the responsibility for integrated materiel inventory management of all Chemical Corps end items. This means that every major function affecting the status of the 1400 different end items in the supply system is performed in this NICP. The NICP for repair parts, located at the Memphis General Depot,

Memphis, Tennessee, has a similar responsibility and controls over 6000 different types of repair parts. Both NICP's are responsible for directing the identification of items, determining requirements, directing that procurement be made for items in short supply, directing disposal of items no longer required, directing the rehabilitation of items requiring maintenance, and controlling the stocks in the system. To perform these functions, these NICP's have been organized along a commodity concept. That is, making an individual segment of the NICP organization responsible for the inventory management of a particular commodity group. As can be seen from Exhibit 1, there are two major commodity groups in the organization of the NICP for end items: major items and secondary items. For the most part, the major items commodity group consists of major equipment, such as flame throwers, smoke generators, and ammunition and toxics. The secondary items commodity group is essentially concerned with general supplies, such as respirators, and chemicals. The NICP for repair parts, on the other hand, has three major commodity groups based on types of end items supported. As can be seen from Exhibit 2, the three groupings are: Weapons, Protective and Safety Equipment, and Detection Devices. The Weapons Branch manages repair parts for items such as flame throwers; the Protective and Safety Equipment Branch is responsible for repair parts for items such as protective masks and collective protectors; and the Detection Devices Branch manages the repair parts for items such as an automatic alarm system.

PERHAPS, at this point, it would be helpful to spell out in some detail the workings of these commodity groups in order to reflect the degree of control that this organization has over the Chemical Corps supply system. The first step that these commodity groups take is the determination of the requirements of the Department of Defense for Chemical Corps items. Periodically, studies are made which use basic data from such sources as tables of organization and equipment, tables of allowances, troop programs, and historical demand, to determine this. These data provide the essential logistical tools to forecast future requirements under varying supply support conditions, such as limited war and general war. The comparison of requirements and assets indicates the amount of procurement or disposal required to bring us into agreement with our commitments for Chemical Corps equipment. When items are procured for stock, the commodity group continues to have an important influence over their disposition. The commodity group will determine where the additional stocks are to be located, and once they are stored, will insure that adequate care and preservation measures are taken to keep them in proper condition. Further, when demands for items are made by customers, the commodity group will direct the timely shipment to satisfy the customers' wants.

In addition to the commodity groups, these NICP's have several other segments in their organization which primarily perform services for the commodity groups. As shown in Exhibit 1, the NICP for end items has three service groups in addition to the two commodity groups. First, the Operations Control Branch performs essentially the bookkeeping operations of the NICP. The accountability for all end items in the supply system is maintained in this unit. Furthermore, this unit handles the flow of documents to commodity groups which affect additions and deletions to the inventory. The performance of these administrative duties by the Operations Control Branch allows the commodity group to devote more time to the important phases of supply control. The Plans and Procedures Branch also relieves the commodity manager of certain administrative duties. This group prepares the procedures by which the customer places demands on the supply system, and procedures which provide for orderly, coordinated flow of actions throughout the NICP. Finally, the NICP for end items has a service element which is concerned basically with managing the many special programs in the supply system. The Special Programs Branch manages the requirements of special programs, such as Strategic Army Corps (STRAC), in addition to the highly important Mutual Security Program. As a result, the commodity group can devote attention to the normal program rather than the exception. As can be seen in Exhibit 2, the NICP for repair parts also has a servicing unit designed to reduce the administrative burden of the commodity group in order that sufficient effort can be devoted toward the more important aspects of commodity management. The Operations Control Branch performs essentially the same functions as the Operations Control Branch of the NICP for end items, that being, acting as a "bookkeeping" agency.

WHILE the day-to-day activities of the NICP are complex, the management of the supply system has been enhanced through the introduction of modern electronic systems. In an effort to speed up the time for processing requisitions from the customer to the depot, a transceiver system was established. This system reduces requisitions to punched cards which are transmitted electronically and reproduced at another location. This has resulted, not only in markedly reducing the time it takes to satisfy customers' demands, but also in reducing that portion of inventory constituting "float" maintained by the customer to compensate for the time it took to process a demand. In addition to the transceiver system, much use has been made of the electronic accounting machines to speed up the burdensome but highly important task of accounting for the diverse inventory, both item-wise and dollar-wise. Finally, studies are now being made concerning the advisability of the establishment of an automatic data processing system at Army Chemical Center. If approved, this system, which includes an electronic computer, will enable the NICP to reduce much of its manual requirements computations as well as reporting requirements to high speed machine computation.

In addition to extensive use of modern electronic systems, management of a substantial portion of Chemical Corps items of supply is enhanced through the use of revolving funds. The Chemical Division of the Army Stock Fund supports all of the repair parts for Chemical Corps items of equipment and all of the inventory managed by the Secondary Items Commodity Branch of the NICP for end items. Speaking item-wise, the inventory financed by stock fund is approximately 90% of the overall inventory. This revolving fund enables the supply manager of the Chemical Corps to insure that consumers are supply-economy conscious. By placing the customer in a position of having to pay directly for all stock fund items that he uses, it is highly probable that he will fully consider the need for an item prior to purchase. Further, better control is effected over the inventory by limiting the commodity manager to only the use of funds generated through the sale of stock fund items when replacement of inventory is contemplated. It is at this point where it is vital that the manager be aware of the demand for a particular item as well as many other factors, such as the probability that

this item will be replaced by a newer and better item, if he is to maintain proper inventory levels. As an example of the favorable effect this revolving fund has had in enabling better management of the Chemical Corps supply system, average stock fund inventories have been reduced 35% since the installation of the stock fund in July 1954.

MANY other techniques are currently in use to aid in the management of the supply system. Programs, such as the cataloging and standardization program have gone a long way in identifying, purifying, and reducing the tremendous inventory of the Chemical Corps. Further, in many instances, customers are now permitted to obtain items of supply direct from the industrial manufacturer rather than go through the military system. This again reduces the requirement for maintaining a huge inventory. While insufficient space prevents extensive treatment of these areas, they are no less important than the ones mentioned.

Because of the atomic age, science and technology are highly dynamic areas of effort. With frequent and important changes not only in the industrial complex but also in the military sciences, it is incumbent upon the Chemical Corps to gear its supply system to the changing needs of the Department of Defense. We cannot afford to be tradition-bound in this area, but rather must make radical changes as necessary if this country is to maintain superiority in its economical and technological race with the Soviets. It is the intent of the Chemical Corps' supply managers that a modern, fast-reacting, economical supply system will be maintained.

A.F.C.A. AFFAIRS

(Continued from Page 4)

FORT DETRICK CHAPTER HEARS DR. EYRING

At Ft. Detrick Chapter's dinner meeting—seated, Dr. Harold C. Weber (left) Chief Scientific Advisor to the Army's Chief of Research and Development; Major General Marshall Stubbs, Chief Chemical Officer of the Army, and A.F.C.A. honorary president; and Dr. Henry Eyring, Dean of the Graduate School, University of Utah, who was principal speaker. Standing are officers of the Fort Detrick Chapter (left to right): Captain John C. Kirch, member-at-large on the executive council; James A. Kime, president; and Samuel Marrone, secretary-treasurer.

At its July meeting, the Fort Detrick Chapter of A. F. C. A. was host to some of the nation's leading scientists, to officials of the U.S. Army Chemical Corps, and to representatives of business and industry from the Frederick, Maryland, area.

The 70 persons attending the dinner meeting were welcomed by the Army's Chief Chemical Officer, Major General Marshall Stubbs, who expressed appreciation of the Chemical Corps for the Frederick community's support of the mission of Fort Detrick.

Dr. Henry Eyring, Dean of the Graduate School of the University of Utah, spoke to the group on "Electrochemical Theory of Interface Reactions." He discussed the theory as it applies to certain fundamental processes in the human body, to the smelting of ore, to the corrosion of metals, to the behavior of semi-conductors used in transistor radios, and to other natural and artificial processes.

The dinner coincided with the first day of a two day meeting at Fort Detrick of the American Chemical Society Committee Advisory to the Chemical Corps.

EXPERIMENTS SHOW CO MAY BE ABSORBED BY BODY AFTER DEATH

EDGEWOOD, MD.—Body tissues may absorb carbon monoxide directly—even after death, Army physiologists have concluded after a series of experiments for the Air Force School of Aviation Medicine. The finding will help investigators determine the causes of an airplane crash.

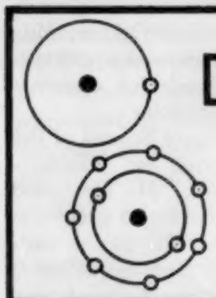
In a number of cases, the finding of carbon monoxide in a plane crash victim had been considered a sign that the victim had breathed the gas while he was still alive, even though no fire had preceded the crash. It has been assumed that the fumes could have caused the crash if the pilot had been overcome.

In studies conducted jointly by the Chemical Warfare Laboratories at Army Chemical Center here, and the Air Force, dead guinea pigs were exposed to carbon monoxide after the animals had been catapulted at a high velocity to simulate the destructive forces of an airplane crash. Carbon monoxide was discovered in their tissues although none had been detected before death.

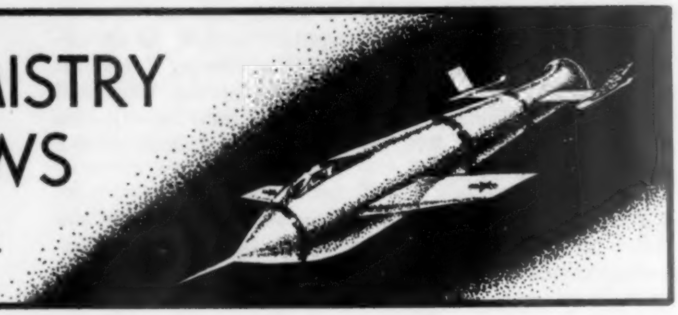
Other experiments gave added weight to a theory that carbon monoxide might actually be forced into body tissues by an explosion. The gas was found in muscle tissue near wounds caused by an explosion, but similar tissue near wounds from other causes did not contain carbon monoxide.

The investigators pointed out, however, that the findings do not rule out the possibility that deadly gas could have overcome the pilot or passengers. The research merely shows that these factors will have to be considered in determining the cause of the crash.

The studies were performed by Matthew J. Wargovich, former Air Force Captain Emil G. Shaw, and the late Dr. Ellis J. Robinson.



DEFENSE CHEMISTRY IN THE NEWS



WILLIAM T. READ, SR.

This Department consists of condensations of news releases and of articles in technical journals relating to developments in chemistry, chemical engineering, and kindred subjects, which are of definite or probable military interest. Unless specifically so stated in the text, the information presented is not to be construed as based upon original or official sources.

NUCLEAR CHEMISTRY

Nuclear energy has been proposed as a method of fixation of atmospheric nitrogen, but it has remained for one of the pioneer companies in the field to suggest that 80% of the fission energy of an element may be used by taking advantage of the recoil energy of fission. The kinetic energy of the fission products, referred to as "recoil energy", produces ionization tracks as the fragments pass through a gas. Temperatures on a micro-scale are of the order of 8000°K to 10,000°K, but the whole gas remains cool, and quenching, so necessary to the arc process, may be obtained. The principle may well be used in other reactions. Heretofore only gamma radiation in photochemical reactions, or use of energy as a source of process heat have been considered. By use of a uranium smoke to get fission fragments into contact with air, nitrogen dioxide may be formed as a source of commercial fertilizers as well as industrial and military chemicals. This method would permit the use of 20 times as much energy as previously considered methods are able to furnish. Boiling sulfur is being investigated as a coolant.

*****

Five different processes are competing in the production of metallium thorium, these being in different stages ranging from present use to pilot operation. They include: calcium reduction of the fluoride; electrolytic reduction of the chloride; sodium amalgam reduction of the chloride; calcium reduction of the oxide; and sodium reduction of the chloride. The last-named process appears capable of producing a metal of 99.8% thorium content, with oxygen present to the extent of 200-500 ppm, which may give it a competitive edge as a reactor fuel. Several thorium breeder-reactors are being constructed, but the amount consumed is relatively small. In addition to its uses in the atomic energy field, thorium is used in magnesium alloys for missiles and rockets, and its compounds have very varied uses in chemical, chemical process, and electronic industries.

*****

Strontium differs from calcium in the way in which it ultimately becomes a component of animal bone. Calcium forms an integral part of bonecrystal nuclei, while strontium deposits on the outside of calcium phosphate nuclei, and enters later into bone structure. Organic chelating agents can take up strontium in the body to form a complex which may be eliminated in ordinary body processes, provided that the agent has access to strontium before it becomes firmly attached to the calcium phosphate microcrystals.

CORRECTION

Our attention has been called to an error in this Department on page 21 of the September-October issue in which ammonium chlorate is given as an oxidizer of a new type of rocket fuel. The substance used is ammonium perchlorate, which was stated correctly in the original press release, the error being in transcribing the manuscript.

Our correspondent states that ammonium chlorate is very unstable, decomposes readily, and must be rigidly excluded in the manufacture of the perchlorate.

METALS

A combination of a rotary kiln, an oil-fired reverbatory furnace, and submerged-arc furnace is now handling a variety of raw materials that otherwise have not proved economical as sources of iron, copper, zinc, and titanium. Iron ore is partially reduced in the rotary kiln, and finally reduced in the arc furnace. Steel and titanium are the products when titaniferous iron ores are the raw materials. Copper slag is fed along with lime, coal, and other reducing agents to the reverberatory furnace, and the products are an iron slag, copper matte, and zinc powder. In the submerged-arc furnace, the slag is converted to semi-steel, which is refined in the usual form of steel-making equipment.

* * *

The process of foaming aluminum was announced some time ago as a pilot-plant operation. The first commercial plant is now going into production. This material is made by mixing zirconium hydride with molten aluminum. The density of the product is 12 lb/sq. ft. The product is corrosion-resistant, waterproof, and can be shaped by extrusion, molding, machining, or pressing into desired form. The first uses will probably be in roofing and building panels. In roofing, the foamed aluminum may be used as a base on which other types of covering may be built. A large number of other uses have been proposed, including not only acoustical and insulating requirements, but where strength and light weight are needed.

* * *

Titanium carbide is said to show considerable promise as a source of high-purity titanium, the process involving electrolysis of the carbide in a fused salt. The carbide costs about as much per pound as titanium tetrachloride, but contains around three times as much titanium. Titanium carbide is reported as behaving during electrolysis like titanium metal high in carbon, and it is possible that other carbides might be employed in the production of metals.

* * *

Very pure tungsten may be deposited at temperatures around 1100°F by the reaction of tungsten hexafluoride with hydrogen. At this temperature the metal drops out, while impurities do not respond to this degree of heat and thus escape. In the initial experiments, the tungsten has been deposited on the inside of a copper tube until

the desired thickness is reached, after which the copper is stripped off to leave tungsten in pure form. The process, however, may be applied to plating tungsten on such surfaces as rocket nose cones, motor walls, and nozzles. This metal melts at 6170°F, and is very hard and resistant to corrosion. There has also been considerable study in the field of vapor deposition of this metal from chlorides.

* * *

Metals that can handle high temperatures or intense radiation require unusual methods of joining by welding. Three of these methods are based respectively on high electrical frequencies, electron beams, and ultrasonics. High frequencies of the order of 450,000 cycles cause localized high-intensity heating, since the current follows the long inductance route, flowing over the metal surface. Mechanical pressure is used to complete the welding operation. Thin sections may be joined, and spiral fins can be attached to alloy tubes. Electron-beam welding avoids contamination of metals. In this process, a tungsten or tantalum cathode emits the electrons, spiral wire being heated to a temperature above 2600°K. The beam is focused by electrostatic or magnetic methods. A third method depends on high-frequency vibrations. Electric current is converted to mechanical vibration. Very thin sections are required. The bond is described as a solid-state, metallurgical bond.

Instead of enormous presses weighing several thousand tons, metals are beginning to be shaped by explosives, a sheet, tube, or cone being formed against a die by a liquid, rubber, or plastic medium. The process is not competitive where a large number of an article is to be made, but is particularly adapted to turning out a limited number of items of special shape. Refractory metals such as molybdenum, tungsten, niobium, and tantalum, and also brittle metals are more readily shaped by this method. Increases of strength up to 30% are recorded in cases of explosive forming as compared with hydraulic pressing. Intricate shapes, such as nose cones and nozzles, appear to be feasible by this method, and no metal is lost in machining.

Using the general technique of explosive forming, presses based on this method have been developed as research tools in the investigation of material behavior and forming. These presses permit recovery of test specimens. One type of explosive press is of sandwich construction, in which two explosive charges are fired at the same time to drive two opposed pistons together in a central cylinder, the material to be formed being between the two. The possibilities of metal forming can be determined by altering the working faces of the pistons, so that the method can best be adapted to special shapes.

The sparking characteristics of metals to be used in explosive atmospheres have been determined in air containing gasoline and enriched by additional quantities of oxygen. Metals identified as safe for tools and other devices in dangerous surroundings include a series of bronzes based on manganese, phosphorus, and aluminum, commercial brass, aluminum, and beryllium copper. In the unsafe class are carbon steels, stainless steel, and monel. Abrasive wheels were found unsafe in combination with metal rods.

A dry film lubricant for ball bearings has been developed that is stable from -300°F to 750°F, and has been operated continuously for 240 hours. The material is a mixture in which molybdenum disulfide and sodium silicate are the main components, together with a smaller amount of graphite. The silicate serves as a binder. Compared with lubricants using organic binders, the new material resisted degradation by heat several times as well, and also gave good lubrication under heavy gamma dosage, while greases became brittle.

NONMETALLIC MATERIALS

A drawback to the use of graphite because of its susceptibility to oxidation can be avoided by impregnating this material with a variety of carbides and oxides. The most effective of the carbides is that of silicon, while boron oxide is the most effective in its class. The heated graphite is quenched in a prepared solution. Impregnated graphite will find use in rocket nozzles, missile guidance vanes, furnace linings, electrodes, and nuclear reactors.

* * *

What has been described as "the most important advance since the transistor" is known as a "tunnel diode." In this device electrons which do not have enough energy to surmount a potential barrier are regarded as "tunnelling" underneath the barrier. The electrons also travel at the speed of light rather than the relatively slow speeds which characterizes them in ordinary semiconductors. Operations at 1500 megacycles have already been carried on successfully, and values up to 10,000 megacycles are expected. A silicon tunnel diode is said to work at 4.2°K, or liquid helium temperature, and functions up to around 320°C. The use of this type of diode is expected to be mainly in communications, and in digital computers. It is not expected that it will replace transistors, but will improve the worth of other components by working with them.

* * *

Unlike conventional ceramic products, a new polycrystalline ceramic is sufficiently translucent that print may be read through a thin disc of this material, when it is laid on the paper. It is made from very pure aluminum oxide, or alumina, which is pressed from the powder form and fired at a very high temperature. It is stable up to 3600°F in contrast to the highest satisfactory operating temperature of fused quartz at 1800°F. Probable applications include infrared lamps, missile nose cones, and many other scientific, military, and industrial uses.

FUELS

Close control of the heat of reforming tubes in a process making hydrogen from natural gas and steam has led to 110% to 130% of original design capacity. Natural gas is scrubbed at 200 psig, mixed with three times its volume of 250 lb. steam, and the mixture is heated to 750°F in a heat exchanger. It then passes to a battery of vertical tubes, packed with an active nickel catalyst. There is no flame to impinge upon the tubes, only radiant heat being received from the burners. At the top of the tubes, heat is furnished to maintain the reaction without overheating the tubes. Most of the carbon monoxide is converted to the dioxide over chromium-promoted iron catalyst, and final removal of carbon monoxide and residual methane follows scrubbing out the carbon dioxide with monoethanolamine.

A great amount of publicity was given to so-called "solidified gasoline" shortly after the close of World War II, but no satisfactory product ever appeared on the motor-fuel market. What are known as "gasoline

bricks" are said to have been developed by the Russians for their International Geophysical Year expedition to Antarctica. A solid emulsion consists of 95% gasoline, trapped in honeycomb-like cells. The material from which the emulsion is made is a water solution of ammonium chloride, casein, polyvinyl alcohol, and glycerine. The viscosity of this liquid is increased by a 20% formaldehyde solution containing oxalic acid, after it is mixed with gasoline. After solidification, the material is pressed into strands, cut into briquet shapes, and dried. Gasoline is recovered by squeezing the briquets, losses being claimed to be as low as 3%. The process is particularly adapted to shipment to regions from which no liquid products could be returned in tank cars, but which have solid materials that may be sent back in the same box cars which carried the gasoline bricks to their destination.

* * *

Jet engines of the type which power modern airplanes are being coupled with low-pressure industrial gas turbines to eliminate the ordinary regenerative system for the combined high- and low-pressure turbines now extensively employed in the oil, gas, and petrochemical industries. The same type of combination has also been successfully used on shipboard as a supplementary power source. The jet engine is sufficiently light so that it may be lifted with a chain hoist, replaced with another, and sent to the factory for overhaul.

HIGH POLYMERS

Polyoxymethylene, or polyformaldehyde, is now being made in large-scale operations from a very pure formaldehyde, polymerization being brought about by an ionic catalyst. The product is a resin which matches the strength of metal, and most of it is expected to be used where brass, aluminum, and zinc are the standard materials. Hardness, rigidity resistance to solvents and water swelling, and a low coefficient of friction are all attained without the drawback of brittleness. The key to the success of the process is attaining stability by capping the ends of the linear polymer by making either esters or ethers, thus preventing attack by water.

* * *

Cushioning materials for delivery of supplies by aerial drop are now being made by copolymerizing castor oil-based polyurethane with such materials as vinyl toluene, diallyl phthalate, and dialluly succinate. The objective of this new method of manufacture is to develop a material less resilient than the former castor oil-based foams, and to secure energy-dissipating properties comparable to foamed glass. These materials are foamed in place, are rigid, and cure under the heat of monomeric materials. Components are stable and can be stored for long times without deterioration.

* * *

Fibers employed in tire cords now include several newcomers, among which are polyesters of the Dacron type and polyvinyl alcohol materials. One company, which is among the leaders in the tire field, considers polyester fibers equal to or superior to any other tire cords in use today. Another manufacturer regards this material of high quality, but cites high price and temperature sensitivity as drawbacks. A polyvinyl alcohol tire cord is being manufactured in Japan, but U.S. rights are in the hands of a large chemical company, which is testing tow and staple of this composition. Japanese claims include much greater durability and less damage from water than rayon, and less degree of extension and greater heat resistance than nylon. Glass fibers are being considered, and steel cable is used in track tires, and, in Europe in passenger car tires.

Both nylon and orlon yarns have been proved to be solar-radiation resistant materials in the manufacture of runway barriers for airfields. Catechol formaldehyde is employed in nylon webbing. These materials stand up as much as 180 days where solar radition is intense, and twice this time in areas of less sunlight. Olive drab materials are more resistant than webbings in their natural color.

Irradiation with high-energy electrons produces increased tensile strength of plasticized polyvinyl chloride by cross linking. By employing a small amount of a tetrafunctional monomer, such as dimethyl acrylate, before irradiation is begun, discoloration by dehydrochlorination is prevented. The additive also serves to cut down the necessary radiation time. The polyvinyl chloride is plasticized with dioctyl phthalate. Radiation is effective in bringing about cross linking when carbon black filler is present, carbon loadings going as high as 34%. Tensile strength is brought about by irradiation, but is increased several fold at temperatures around 150°C.

Cotton fibers are continually being improved by a variety of chemical treatments, of which two have been recently announced. Two silicon derivatives, which polymerize separately but act together, are tetravinylsilane and methyl hydrogen siloxane. These compounds operate in an aqueous emulsion containing ethylated oleamide, and give excellent water repellency to cotton. If a triazone resin is dissolved in the mixed polymers, often referred to as an organic alloy, the treatment combines crease resistance with water repellency. Cellulose chains may be cross linked with formaldehyde, and if the fibers are swollen, they remain swollen after the treatment and resist wrinkling when wet. However, they do not resist the formation of wrinkles when they are dry. A collapsed fiber will remain collapsed when cross linked, and resist wrinkling either wet or dry. The correct amount of water in the solution of formaldehyde in acetic acid, which is about 9%, causes very little swelling, is apparently responsible for this ideal process.

CHEMICAL ENGINEERING

Until recently liquid hydrogen has been handled only in small quantities in laboratories. Its use as a rocket fuel has raised questions as to hazards in only in small quantities in laboratories. Its use as a rocket fuel has raised questions as to hazards in connection with its storage and transportation. Recent researches indicate that the dangers associated with liquid hydrogen in large quantities are not nearly as great as anticipated. When liquid hydrogen is spilled from a tank and mixes with air, the probability of the right proportions and the right intensity of shock occurring at the same time is relatively small. Burning rather than detonation is what would most likely take place in case of ignition. The peak emissivity of a hydrogen flame is about one tenth that of a propane flame, and the peak lasts only a fraction of the time of that of liquified petroleum gases. The safe distance from fires of the two fuels are of the order of 180 feet for hydrogen and 675 feet for JP-4 fuel. Unless

solidified air is greatly enriched with oxygen, liquid hydrogen containing it is not likely to detonate. Impact sensitivity of liquid hydrogen and solid oxygen is about that of RDX.

Transportation of liquid helium and liquid hydrogen has been greatly advanced by the development of evacuated jackets for containers ranging from 40 gallons up to 8,000 gallon tank trailers. The most efficient type of insulation to be placed between the inner and outer walls consists of many layers of glass-fiber paper, the fibers being of submicron dimensions. With the paper are alternate layers of aluminum foil. The space is evacuated to a pressure of one micron or less. Daily loss by evaporation is reported as 2%. Another filler that is somewhat less expensive and still adequate for many cryogenic uses is powdered copper or aluminum mixed with silica. In handling liquid oxygen, copper is regarded as being the safer of the two. A further improvement is being tried in reducing the size of the aluminum powder to as low as 0.03 microns as compared with 20 to 40 micron material.

Liquid fluorine, the powerful rocket fuel oxidizer, is being handled in tank cars with triple shells. The outermost space is filled with perlite or Santocel, and is evacuated. In the space between the innermost and middle shell is liquid nitrogen at -320°F. The liquid Fluorine is at -306°F. Before transferring this material to the tank trailer, the interior is carefully cleaned with aqua regia, cold trichlorethylene, hot alkali, and deionized water. After drying with acetone and purging with anhydrous nitrogen, the tank is tested for leaks with helium under pressure. Gaseous fluorine containing a small amount of hydrogen fluoride is introduced to produce a passive fluoride film on the inner surface, after which liquid fluorine is introduced under helium pressure.

Ethylene, which is commonly transported in pipe lines is now being shipped in insulated tank trucks as a liquid at -155°F. The distance covered by the trucks is over 500 miles. The insulation of the trucks is 9 inches thick and is expanded polystyrene.

Undesirable flavors are commonly removed from cream by warming it and subjecting it to a high vacuum. The same process is now being applied to take 95% of such flavors as those caused by cows eating onion tops, alfalfa, and beets tops. The milk is heated to 194°F by injected steam and is exposed to a vacuum of 9.5 inches of mercury, and the concentration of milk solids and fat is maintained by holding the outlet temperature of the milk to a few degrees below that of the milk before exposure to vacuum. In states in which steam injection is prohibited because of contamination by water-treating chemicals, water and volatiles are removed from the milk under vacuum, and the process is said to be nearly as effective as the use of steam, but less volatile materials are not removed. When milk is pasteurized at temperatures above 200°F, some undesirable flavors are produced in otherwise good milk, and pasteurization precedes vacuum treatment.

In addition to bringing about separation of unwanted hydrocarbons from motor fuels, molecular sieves are now being employed in preference to other commercial dessicants for the removal of water from hydrogen-rich "off gases" from petroleum refineries. Molecular sieves are made up of silicates and aluminates of alkali and alkaline earth metals, and have precisely uniform pore sizes. They adsorb molecules of certain sizes and reject other larger molecules. They will thus take up water and reject large molecules such as acromatics and branched-chain hydrocarbons. Dryers containing molecular sieve material are periodically regenerated by hot hydrogen at temperatures somewhat under 400°F.

Molecular sieves are described as consisting of three-dimensional frameworks of the orthosilicate radical, SO_4 and aluminate radicals, AlO_4. The electrovalence of each tetrahedron is balanced by such metal cations as sodium, calcium, and magnesium. Spaces between the tetrahedra hold water molecules, which are removed by being heated in kilns. The voids left by the removal of water are regarded as "molecular traps." A process carried out by one large manufacturer of these materials includes mixing sodium silicate, sodium aluminate, and sodium hydroxide solutions to form a gel, from which crystals are formed. These crystals are filtered and washed. Solution ions may be replaced by calcium ions to any desired extent by mixing the filter cake with a calcium chloride solution, the process being a typical ion-exchange operation. Pellets are made by mixing the zeolite crystals with clay binder and extruding the mixture. Pellets are heated in a rotary kiln at 1200°F to drive out the water and bring about activation. The product is placed in sealed drums to prevent taking up moisture from air.

A paste of equal parts of silver chromate and lead chloride in a thinned, phenolic-base, spar varnish and applied to pressure vessels operating up to 500°F will detect steam leakage by change of color. The material reacts with both cold and hot water, and is stable at high temperatures and at high humidity at ambient temperatures. It is easily applied and also easily removed by wire brushing.

INSTRUMENTATION

Infrared spectroscopy has been found to be an efficient method for determining the stability of polymeric coatings to ultraviolet radiation. This has also been found to be roughly parallel to the ability to withstand gamma radiation. Coatings were examined after exposure to a near ultraviolet source for 200 hours. The most stable polyers were polystyrene, melamine formaldehyde, and urea formaldehyde products, with stability decreasing through styrenated and soya oil alkyds, silicones, and polyvinyl chloride.

As a by-product of the detection of leaks in refrigeration systems and in the fuel tanks of jet airplanes by means of nitrous oxide, there is a proposal to use this gas in hydrostatic tests of underground pipes. This substance is readily detected by an infrared analyzer. At hydrostatic pressures of 1500 psi, the gas is quite soluble, but escapes from the liquid coming from a leak, and soon reaches the surface. As little as 0.007 pounds escaping per hour can be detected with leak rates as low as 2 gallons an hour. Nitrous oxide does not occur naturally, as do several of the common tracer gases, and it is not toxic, irritating, or explosive, and is also quite cheap. The test solution can be recovered and used again, an analyzer on a truck can cover miles of pipeline in a relatively short time.

MATERIEL VS. ENVIRONMENTS

By Alfred N. Bloch
Statistical Engineering Unit
U.S. Army Chemical Corps Engineering Command

In a previous article, it has been explained that, at the present state of the Art, the global usability and the life span requirements cannot be designed into a product. Only its actual exposure to the various environments proves its suitability and discloses its useful life. It has also been explained why this after-the-fact information is not satisfactory. It will be shown here how the much needed knowledge on the mechanisms of deterioration could be generated.

Wherever the Navy establishes an operation base, it builds piers out into the water for use as landing, loading and unloading facilities. As a rule, those piers are structures supported by wooden posts or pillars, which are driven into the ocean floor and are continuously or intermittently exposed to the sea water. In the Canal Zone, the Navy ran into difficulties with those wooden support pillars. Some marine organism developed a pronounced liking for that wood and bored its way into it. As a result, these pillars disintegrated prematurely, and their frequent replacement was an expensive affair. The responsible Navy scientists took an interest in this phenomenon. They collected samples of all domestic woods, submerged them in sea water in order to determine their susceptibility to that inconsiderate marine worm. After some time they were thus in a position to arrange those woods in the order of their resistance to the sea water and marine life exposures.

Of course the most resistant woods were the most expensive ones. But the Navy scientists synthesized those suitable woods, impregnated the cheaper and susceptible woods with those synthetic materials and thus rendered the inexpensive pillar materials resistant to the effects of that particular marine organism. Moreover, on the basis of this new knowledge, the Navy was in a position to insist on life span requirements in their procurement of pillars for piers; could, in addition, advise the producer how to meet these requirements, and has saved considerable amounts of money since in its pier-building activities.

This Navy investigation was environmental engineering research at its best because the investigation was not restricted to the determination of the suitability of those woods for the particular purpose. It advanced deeper into the problems involved and developed valuable remedial means. Nevertheless, the study did not proceed far enough. It stopped short before achieving the logical and desirable goal: The detection of those characteristics which made the suitable woods resistant to the attacks of that marine organism and to the sea water exposures. Such knowledge would have provided us with a clear-cut criterion for deciding on the adequacy of a wooden material for use as pier supports.

The story of the wooden pillars has been reported here in some detail, because it illustrates our approach to environmental investigations. If conducted according to scientific concepts, they will be concerned first with the analysis of the deterioration phenomenon of an item. WE WANT TO KNOW EXACTLY WHAT HAPPENS!

Any product in storage or use is, as a rule, subjected to internal and external forces or stresses. In the course of time, these stresses cause considerable--mostly undesirable—changes in the item, which sooner or later are liable to affect its usefulness. These changes are the result of physical and chemical processes generated by those stresses. They are the changes which we use to interpret as indications of aging. The scientific approach to the aging problem calls for the detection and the clear definition of every one of the chemical reactions and changes in the physical characteristics that take place in the item under investigation.

As a rule, aging is a very slowly progressing phenomenon. The first indications of aging are, of course, of microscopic nature, not noticeable to the naked eye. The available chemical and physical investigation methods and tools are, however, sensitive enough to detect such phenomena at an early stage and to analyze them properly. Thus, this is knowledge which can be generated early in the post-manufacture period of an item.

Our second concern is the proper classification of the established deterioration process. We might be interested in the rates of the various chemical reactions and physical changes. This suggests the arrangement of the various processes in the order of their progress. Such

Mr. Alfred N. Bloch, a native of Alsace-Lorraine, received his professional education (mathematics and physics) at the College of Muelhausen and at the Universities of Strasbourg and Munich. After completion of his post-graduate studies at the University of Munich, he was appointed professor ("Studienrat") in Bavarian civil service. He has been connected with the U. S. Army Chemical Corps since 1951. He is employed at Engineering Command headquarters at Army Chemical Center, Maryland, as Staff Scientist in the Office of the Chief Engineer, engaged in the application of Science to engineering problems.

listing will be referred to as "deterioration pattern." We consider it extremely useful and important. Properly assembled, it describes the aging phenomenon under investigation in all details, and properly interpreted, it offers the information needed for the evaluation of the environmental suitability of the item.

However, the deterioration pattern must be refined to truly serve these purposes. First of all, we have to distinguish between harmful, harmless, and desirable aging processes and establish these categories for the rearrangement of our deterioration pattern. As a rule, we will not interfere with harmless deteriorations and certainly not with desirable aging processes (they might become critical only when equipment has to "shine" for inspections or exhibitions). Secondly, the rate of progress does not necessarily indicate the degree of undesirability of a harmful deterioration process. One deterioration phenomenon may very well be more harmful in its early stage than another one in its advanced stage. This reasoning calls for the grouping of the deterioration processes according to degrees of undesirability or according to their deterioration "potential." In this refined form, the concept "deterioration pattern," properly applied, will develop into an extremely powerful tool for the exploration of aging. This will be proven in a feasibility study, in which, in addition, the first series of typical deterioration patterns will be evolved.

At this stage of the game, it will become necessary and we will be in a position to establish the scope or range of the aging investigation.

The aging or deterioration of a product is caused by the environment in which the product is stored or used. Deterioration varies, therefore, in kind and rate with the prevailing climatic conditions. We speak of tropical, desert, temperate, and arctic exposures. However, anyone of these natural environments has many shades or variations. As a result, the deterioration patterns of an item cannot be expected to be identical throughout one of the climatic zones. On the other hand, all variants of a particular natural environment have essential characteristics in common (the characteristics which make them a part of the overall classification, tropical, desert, etc.) We should therefore be in a position to define for each natural environment the characteristic deterioration pattern for our item. Of course, in order to arrive at such a simple representation of the deterioration phenomenon, it might become necessary to sub-divide the basic natural environments and to distinguish for example between marine conditions and continental conditions in each climate.

We have now arrived at a limited number of deterioration patterns by means of which we can describe the aging of an item anywhere on the globe. For comparison purposes, this deterioration information will be generated for the various types of products or materiel in which we are interested. We want to find out whether or not there is a relationship between the deterioration patterns of items exposed for example to the temperate marine environment of the Baltimore area and everyone of the other typical exposures. If such relationship exists, and if we could develop a mathematical model which expresses it, all environmental investigations could be confined to just one environment, and this would ease our job considerably. With our present very limited knowledge on aging, we cannot venture even a guess whether or not such simplification of the problem can be expected.

With representative samples of deterioration patterns in the typical environments at our disposal, we are now in a position to check the validity of our present conventional climatic chamber tests. For that purpose, samples of an item will be exposed in the tropical, the desert, and the arctic climatic chambers over the prescribed storage periods. The deterioration pattern and the rate of progress of the aging process for each item will be established in each chamber. The climatic chamber patterns of the items will then be compared with the corresponding deterioration patterns obtained through exposures in the natural environments. If the chamber patterns approach the corresponding natural exposure patterns closely enough, the validity of our present procedures would be proven beyond the shadow of a doubt. If, in addition, the progress of deterioration during the chamber exposures indicated the state of deterioration of the item in the natural environment over a much longer period, we would have proven at the same time that with our conventional chamber exposures we can achieve the required undistorted acceleration of the aging process, and there would not be a reason for any change of procedure. Unfortunately, such happy ending cannot be anticipated.

We contend that a climatic chamber can serve its purpose only, if it truly simulates the *total* environment it is supposed to represent. This has never been attempted before, and it is questioned whether environmental engineering has developed the tools for the realistic simulation of all climatic stresses of an environment. However, chambers which simulate the essential single climatic stresses are on the market; also chambers which generate more or less closely selected combined climatic stresses. Thus, it should not be too difficult to advance to the artificial re-creation of any desired total environment, as soon as a genuine demand for it is noticed. Such chambers would be of invaluable advantage to any scientific investigation of aging and the efforts towards its control. However, the availability of climatic chambers in which all desired environmental stresses can be generated at will within the needed ranges is not enough. We have to define in addition a standard climatic year for everyone of the typical environments and must be in a position to simulate it for the conduct of our investigations. The re-creation of any previous climatic year of a particular environment is not satisfactory, even if all needed meteorological data are available. It might have been a very mild year or a very severe year. We are interested in the definition of a standard climatic year in all its weather variations which exactly reproduces the typical deterioration patterns of our test items in the particular environment. It will be an average year which can be statistically computed from the available long-term meteorological data of the particular environment.

In the climatic chambers which simulate total environments, the weather will be under our full control. These chambers provide us with the tools for the scientific exploration of deterioration or aging. We are now in a position to determine through experimentation the causes of each deterioration process in the items under investigation. In order to verify our findings, we are equipped to re-create any climatic condition at will and to attempt thus to reproduce any desired deterioration process.

The resulting knowledge will be used to advance to the ultimate goal of this investigation: The design of environmental resistance features for the control of deterioration. For this purpose, we study in the order of their listing the undesirable deterioration processes recorded in the deterioration patterns of the item under study. If possible, we want to suppress them completely. Of course, some of them will resist such elimi-

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MARINES!—"ALL IS WELL"

THE ABOVE picture shows Marines demonstrating the Marine tactical specialty of the "vertical envelopment" in amphibious operations against a hostile shore.

The new Marine landing tactics and technique exploit the characteristics of the helicopter, taking advantage of its adaptability to terrain and ease of employment in large numbers to land fighting forces to the rear instead of in front of a defended beach.

The development and perfection of these tactics by the Marines has been underway for some time and has received considerable public notice. However, it was of especial interest to A.F.C.A. members to hear directly of this new type of landing on a hostile shore in the address by Brigadier General G. R. E. Shell, Deputy Chief of Staff, R&D, Headquarters U. S. Marine Corps, at A.F.C.A.'s annual meeting in Washington, D. C., last September.

Another noteworthy event reflecting the long-standing cordial relationships between the Army Chemical Corps and the U. S. Marine Corps was a visit last August to the Army Chemical Center, Maryland, by General Randolph McCall Pate not so very long before his retirement as Commandant of the Marine Corps on 31 December last. At the time of General Pate's visit, Brigadier General Harold Walmsley, who himself has since retired, was the Commanding General at Edgewood.

Gen. Pate Visits Edgewood

Both of these events lend particular interest to the photograph herewith taken during General Pate's Edgewood visit. Here he is shown inspecting the guard of honor which was turned out for him upon his arrival at the Post. The Commander of the Guard (on the immediate right of General Pate) is Captain Charles Creamer, and at the extreme left is General Walmsley.

General Pate spent the day touring the Chemical Center's facilities and hearing the latest advances in chemical warfare. His visit no doubt will be appropriately listed in Edgewood's "log" of memorable events.

General Pate, the 21st Commandant of the Marine Corps, is a veteran of the Korean fighting, World War II action at Guadalcanal and Iwo Jima, and pre-World War II expeditionary service in Santo Domingo and China. He has been a Marine officer since 1921.

In Korea he commanded the First Marine Division,

where he won the Distinguished Service Medal and the Republic of Korea's Order of Military Merit.

In World War II he was cited for outstanding service as Deputy Chief of Staff to the Commanding General, Fleet Marine Force, Pacific, and was awarded the Legion of Merit for his performance of duty during amphibious operations on Palau, Iwo Jima and Okinawa. In 1947 he was awarded a gold star in lieu of his second Legion of Merit in recognition of his exceptionally meritorious service at Guadalcanal as Assistant Chief of Staff for Supply of the First Marine Division during the first offensive against Japan.

General Pate was born at Port Royal, South Carolina, on February 11, 1898. He served a short tour as an enlisted man in the Army in 1918, subsequently entering Virginia Military Institute, where he was graduated in June 1921, and commissioned as a second lieutenant in the Marines.

Gen. Shoup, The New Commandant

Lieut. General David Monroe Shoup took over as 22d Commandant of the Marine Corps upon the retirement of General Pate. Concurrently he was promoted to the grade of full General—four stars.

General Shoup holds the Nation's highest award, the Medal of Honor, which he won as a colonel during the assault at Tarawa in World War II. The citation accompanying this award states in part:

> "For conspicuous gallantry and intrepidity at the risk of his own life above and beyond the call of duty as commanding officer of all Marine Corps troops in action against enemy Japanese forces on Betio Island, Tarawa Atoll, Gilbert Islands, from November 20 to 22, 1943. . . .
>
> "By his brilliant leadership, daring tactics, and selfless devotion to duty, General Shoup was largely responsible for the final, decisive defeat of the enemy and his indomitable fighting spirit reflects great credit upon the United States Naval Service."

For the same performance he was also awarded the British Distinguished Service Order.

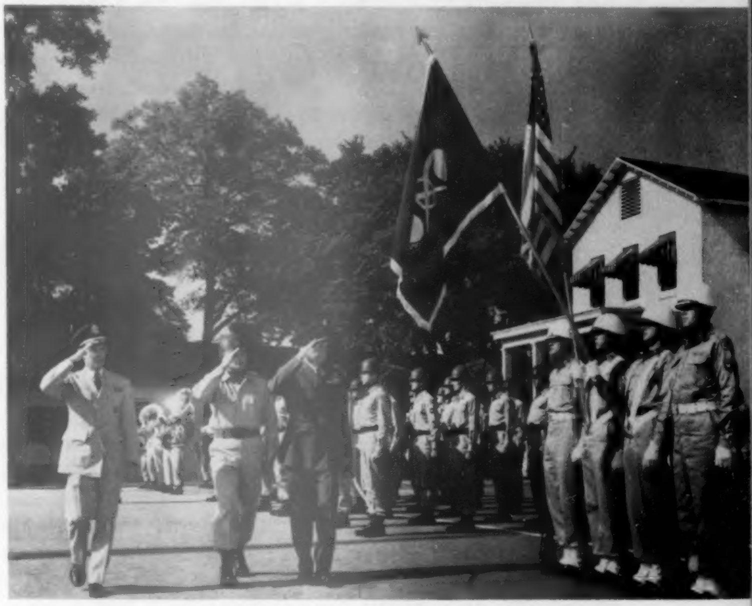
General Shoup, whose appointment to take over from General Pate was announced some months ago, was born December 30, 1904, at Battle Ground, Indiana. A 1926 graduate of DePauw University, he was a ROTC cadet at the University and served for a month as a second lieutenant in the Army Infantry Reserve before being commissioned as a second lieutenant of the Marine Corps on July 20, 1926.

His service, as in the case of most senior Marine officers, has been marked by far-flung and varied assignments, from Philadelphia to Tientsin, China.

GENERAL PATE

GENERAL SHOUP

In 1943 he served on temporary duty for a time with the Civilian Conservation Corps in Idaho before again being ordered to China. Service with the Fourth Marines at Shanghai and at the American Legation in Peiping followed, with his return to this country via Japan.



Gen. Pate visits Army Chemical Center, Md.

MATERIEL vs. ENVIRONMENT

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nation. In such cases, we will be satisfied if we can weaken them sufficiently to render them harmless for the duration of the useful life of the item. We remember, any deterioration process is either a physical or a chemical phenomenon. Chances are, that its control can be achieved through the application of established knowledge in those areas. All deterioration processes of unknown or unexplored nature will be subject to experimentation in our modernized climatic chambers.

Present day environmental engineering uses accelerated surveillance for the short-term determination of the environmental suitability of a new design. Even if this technique were foolproof, it would only distinguish between acceptable and unacceptable items as far as global usability is concerned.

We advocate for the conduct of the aging investigation the "natural approach:" With the use of the deterioration patterns we expect to advance to the "elements of aging" and will thus be in a position to *diagnose the evil*, to establish early in its development the environmental shortcomings of an item. With the incorporation of the necessary environmental resistance features into the design, we expect to *cure the evil* and to engineer an item of which we know *in advance* that it will serve its intended purpose in any environment and over any desired period of usage.

However, the efforts reported here cover only what we call the "reasoning phase" of the aging project. In our justification for the need of such a project, many statements were made, which, though logically sound, will have to be substantiated by concrete evidence to be acceptable. We are fully aware of this obligation. Thus, we are waiting for the opportunity for introducing "environmental prophylaxis" into products design.

FRITZ HABER
FATHER OF CHEMICAL WARFARE

By Wyndham D. Miles, Ph.D
U. S. Army Chemical Corps Historical Office

By permission of the Journal of Chemical Education
FRITZ HABER

The origin of the U.S. Army Chemical Corps might well be considered as due to the noted German chemist Fritz Haber. It was he who conceived the plan of unleashing chlorine against Allied troops in the early days of World War I. After gas routed French colonial troops at Ypres on April 22, 1915, giving the Germans a sizable chunk of territory and a number of guns, every nation had to reckon with toxic agents on the battlefield. As a result the United States began preparations for chemical warfare in 1917 and created the Chemical Warfare Service the following year.

When Germany went to war in 1914, no one, knowing Haber, could have guessed that he would soon become the father of chemical warfare. He had not been overly interested in military affairs, and he had not worked with toxic compounds. His first venture into research back in the 1880's had been on derivatives of piperonal, a compound used in perfumery, and indigo, a dye. Then he had gone into industry to gain experience that he felt would be useful to him later in his father's chemical and dye business. But Haber did not join the family firm. Finding industrial work too stifling the young man turned to the academic world. These were the great days of organic chemistry. All over the world chemists were synthesizing new, unusual compounds, while a growing chemistry industry was developing methods of producing the compounds on a commercial scale. Haber started out by investigating the constitution of diacetosuccinic ester. Then he shifted his sights to the pyrolysis of hydrocarbons. In the course of the latter work he made several discoveries that proved valuable years later when cracking processes were developed by the oil industry.

However, the enthusiasm that carried him into organic research waned. Through a fellow chemist he found a new interest in physical chemistry. In the 1890's physical chemistry was still on the frontier of science, and it had not been a part of Haber's training. He had to teach himself. He started out in electrochemistry, and traced the complicated path of the electrolytic reduction of nitrobenzene. Soon he demonstrated the importance of electrode potential in oxidations and reductions, and put forth a general theory of electrochemical reduction. He studied the electrochemistry of crystalline salts. He developed the theory of the glass electrode. For streetcar companies he carried out an investigation of considerable practical importance to find out how stray electric currents caused corrosion of underground water and gas mains. In 1898 he published his *Fundamentals of Technical Electrochemistry from a Theoretical Basis,* the first of a half dozen books.

In 1904 Haber began work on what turned out to be his most important achievement in physical chemistry, the synthesis of ammonia from nitrogen and hydrogen. By studying equilibria and testing various catalysts he finally worked out the conditions necessary for the reaction. At temperatures around 500°, with the proper catalyst, and under pressures of 150-200 atmospheres, he was able to obtain significant percentages of ammonia. Pressures of this magnitude were unheard of in industrial plants at that time, but the Badische und Anilin Soda Fabrik threw its great engineering resources into the project and developed the process to the commercial stage. For his share in this feat Haber received the Nobel prize in 1919, and Carl Bosch, a Badische engineer who devised methods for carrying out the reactions under high pressures, the prize in 1931.

To return to prewar Germany, in 1911 Leopold Koppel, a wealthy industrialist, provided funds for the erection of a research organization named the Kaiser Wilhelm Institut für Physikalische Chemie und Elektrochemie. His only condition was that Haber would be the director. It was in this post that the outbreak of war found Haber in August, 1914. He volunteered for war work, and the German War Ministry placed him at the head of the department of raw materials. This position was more important than the name may indicate, for the Germans, assuming that their industrial plants would be able to supply everything the Army needed, had not provided for sufficient stockpiles of raw materials in their mobilization plans. Actually the stock of some raw materials was so low that the Germans were ill-prepared for even a short war. In the case of saltpeter, the source of nitric acid needed for the manufacture of explosives and fertilizers, Haber found the quantity on hand dangerously short. In time of peace Germany had imported saltpeter from Chile, but now the British fleet blocked the shipping lanes between South America and the North Sea. The only other practical source of nitric acid was ammonia, and this led Haber to promote the erection of conversion plants. For the first two years of the war ammonia from the cyanamide process and the coke industry barely furnished sufficient nitrates for the Army, leaving little to spare for agriculture. But in the second half of the conflict the steadily increasing output of synthetic ammonia from

the Haber process was able to meet all of Germany's demands. It has been said that without Haber's ammonia process Germany could not have lasted as long as it did.

ASIDE from poor mobilization planning, the German Army made another mistake in assuming that the war would be swift and short. It was this way for the first few weeks, but then the French Army halted the Germans at the battle of the Marne in September 1914, and the Allies dug in. The Germans were checkmated. They could not touch Allied troops with rifle fire and they could not blast them out of the ground with high explosives. The General Staff, realizing that time was on the side of the Allies, wanted desperately to get their opponents out of the trenches and sweep them aside. Suggestions had been made many times before 1914 for the use of toxic chemicals in driving soldiers out of fortifications, but the Germans had not anticipated any need for chemicals and had not made preparations to employ them. After the war began the Germany Army, according to German writers, received reports that the Allies were preparing some sort of chemical munitions. Whether this is correct or not does not concern us here. The important thing is that the German Army realized the fact that gases or air-borne particles could penetrate every nook and cranny of the Allied trenches, and might possibly force the troops into the open.

The War Ministry consulted Walter Nernst, one of the country's foremost chemists, regarding physiologically active compounds that might be used in shells. Nernst suggested dianisidine chlorosulfonate, an irritant, and xylyl bromide, a lachrymator. The Army made up a trial batch of shells filled with these compounds, but the munitions were not effective because they could not hold sufficient material to discharge a high concentration of the compound in the air. Experiments with other fillings were begun by Haber and a group of chemists, one of whom, Otto Sackur, was killed instantly when a bottle of dichloromethylamine exploded. In the course of his work Haber came to the conclusion that shells were not a practical means for delivering toxics to the enemy. He calculated that too many shells and cannon would be required (this was true at the time and under the circumstances, but as chemical warfare evolved shells came into use). He considered other means of employing chemicals, and finally hit on the idea of releasing a gas into the air and letting the wind blow it into the Allied trenches. For the gas he chose chlorine, because it could be manufactured readily, was available in large quantity, and would dissipate into the atmosphere rapidly, allowing German troops to advance quickly into the gassed area. General Erich von Falkenhayn, Chief of the General Staff, accepted Haber's idea, and in January, 1915, the Germans began planning the operation. Field experiments were carried out, in one of which, near Hasselt, Belgium, on April 2, Haber ventured so far into a gas cloud that he was almost overcome and had to be carried from the field on a stretcher.

NAVY BUREAU OF AERONAUTICS HOSTS PROPELLANT SYMPOSIUM

"Liquid Propellant and Rocket Engine Research and Development" was the theme of the first Joint Army-Navy-Air Force Liquid Propellant Symposium which was held in New Orleans, Louisiana, on 3, 4, and 5 November 1959.

This was the first of a series of meetings arranged by the Liquid Propellant Information Agency (Johns Hopkins University, Applied Physics Laboratory), which was established by the Navy's Bureau of Aeronautics in August 1958. The support of the Agency is a tri-service effort, under the Bureau of Aeronautics administrative management.

The meetings have as their primary purpose the promotion of a free and direct exchange of scientific and technical information. Hostship of the series of symposia is to be on an annual rotating basis.

Approximately 500-600 leaders of business, industry and education from all sections of the United States were expected to be on hand to hear of the recent "classified" advances in the field of liquid propellants and liquid rocket engine research.

Mr. R. J. Kauffman, Rocket and Diverse Engines Branch, of BuAer's Power Plant Division, was General Chairman.

ATOMIC REACTORS FOR OMAHA VA HOSPITAL

An atomic reactor, believed to be the largest ever installed in a hospital and one of the first designed specifically for medical purposes, has been placed in operation at the Veterans Administration hospital in Omaha, Nebraska.

Dr. W. Edward Chamberlain, who heads the VA's atomic medicine program in Washington, D.C., said the reactor opens new doors for patient care, research and education and training for the agency.

The reactor is housed in a vertical concrete tube 22 feet deep and 6½ feet in diameter, sunk into the ground beneath the Omaha VA hospital.

Nestled in this shaft, it "swims" in 4,750 gallons of highly purified water—triple-distilled to remove solid particles that would lessen the water's effectiveness as shielding against escape of radioactivity.

A unique built-in safety design completely eliminates any danger of an atomic explosion. The fuel rods are of a material that stops the nuclear reaction when it begins to get hot.

The reactor will enable VA doctors to delve into previously inaccessible areas of medical and biological research.

Studies into the essence of human growth—how food is converted into energy, muscle, and bone—will be possible.

By producing radioisotopes, the reactor will enable the VA to increase substantially its use of these for medical treatment and research, said Dr. Richard E. Ogborn, chief of the Omaha VA hospital's radioisotope service.

DR. BROWN'S RESEARCH IN ENGLAND PRODUCES GAS CASE THERAPY DATA

EDGEWOOD, MD.—Dr. Robert V. Brown, Chief of the pharmacology branch at the Chemical Warfare Laboratories, has returned to his job at Army Chemical Center after spending 13 months in England at the British Chemical Defense Experimental Establishment at Porton. He collaborated there with British experts in studying the prevention and treatment of war gas casualties.

A native of Mississippi, Dr. Brown has a doctorate in physiology and pharmacology from the University of Chicago.

On April 22, after several postponements because the wind refused to blow in the right direction, Colonel Peterson's Pioneer Regiment No. 35, nicknamed the "Peterson Gas Regiment," opened the valves on chlorine cylinders emplaced near Ypres, and chemical warfare was born. The German Army underestimated the effectiveness of the gas attack. Instead of massing their reserves and bursting through the gap in the French lines they settled for a limited objective. By the next day the Allies had recovered, plugged the hole, and Germans had lost their opportunity. Instead of a great strategic success they gained a minor tactical victory.

Following the initial chemical attack Haber occupied himself with the design and production of gas masks. After the French surprised the Germans by bringing out practical chemical shells in 1916, the German War Ministry placed Haber in charge of development of gas projectiles. Late in 1916 the Army formed a separate chemical warfare organization with Haber as its chief. During the final two years of the war Haber, with rank of captain, controlled the entire organization, with responsibility for research, development, supply, and training. He also acted as advisor for gas operations on the battlefield.

With the coming of peace Haber returned to the Kaiser Wilhelm Institut. Troubled over Germany's financial problems he devised a scheme for paying her war debt. A Swedish chemist, Svante Arrhenius, had estimated that the oceans of the world contained 8,000,000,000 tons of gold, held in suspension. Haber calculated that 50,000 tons of this gold would settle the war claims. In 1920 he organized a group of chemists and set them to work analyzing sea water and devising a process for extracting gold. The analyses revealed only a minute amount of gold in sea water, about 5 milligrams of metal in a ton of water, but the chemists worked out an extraction process so efficient that it was possible to make a profit on each ton of water. In 1923 Haber and his staff set out across the Atlantic on a ship fitted with a laboratory and an extraction plant. To their astonishment the men found much less gold in the water than they had expected. Checking carefully over their preliminary analyses they found that an infinitesimal amount of gold had been present in their reagents and reaction vessels, and that this gold had found its way into their samples, making their results too high. Instead of containing 5 milligrams of gold, a ton of sea water contained less than one-thousandth of the amount. This quantity was too small to be extracted profitably, and in 1926 Haber abandoned all hope of success.

The sea water episode absorbed the major part of Haber's energy between 1920 and 1926, but he found time to widen the activities of the Kaiser Wilhelm Institute. Scientists studied resonance phenomena, absorption spectra, para-hydrogen, free radicals, colloids, photochemical reactions, and chemical applications of Planck's quantum theory. It became one of the great research centers of the world. By 1929 nearly half of its sixty members were from outside of Germany. But neither the international fame of the Institute nor the great work that it was doing saved it from the Nazis. Haber was Jewish, as were several of his colleagues. In 1933 Haber resigned, went to Switzerland, then to the University of Cambridge. He was ill, distressed by misfortune, and no longer a young man. For a rest he went to Switzerland where he suffered a heart attack and died in January 1934.

Haber visited the United States twice. In 1902, when he was thirty-four, the Deutsche Bunsen Gesellschaft sent him as their delegate to a meeting of the American Electrochemical Society. During this visit Haber travelled over the country, visited plants and universities, and upon returning home published a 64-page article in the *Zeitschrift fur Elektrochemie* (1903) on chemical education and the electrochemical industry of the United States. This article is of importance in the history of American chemistry for the view that it gives of American chemistry at the turn of the century.

In 1924 Haber passed through the United States while on his way to Japan to introduce the Haber nitrogen process there and also advise on the Japanese chemical warfare program. He stopped in Washington, had lunch with Major William N. Porter* and then, accompanied by Major Porter, took a quick trip to Edgewood Arsenal. Major Porter noted that Haber evidenced little interest in Edgewood Arsenal except as an example of the American scale of doing things in peace or war.

What did impress Haber, according to Major Porter, was the industrial and scientific progress that the United States had made in the twenty-two years that had passed since his first visit.

In 1952 with the Nazi party stamped out, German chemists were again able to show admiration for Haber. On the fortieth anniversary of the Kaiser Wilhelm Institut they unveiled a memorial placque to Haber. The inscription reads as follows: "Themistocles entered history not as the exile at the court of the Persian King, but as the victor of Salamis. Haber will live in history as the brilliant discoverer of that method of combining nitrogen with hydrogen, which is the basis of the technical fixation of atmospheric nitrogen, as the man who created, as was stated at his receipt of the Nobel Price, 'an exceedingly important means of advancing agriculture and the welfare of the people,' who obtained bread from air and won a triumph in the service of his country and all mankind."

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* Now Major General, retired. Became Chief of the Chemical Warfare Service and served in that capacity throughout World War II.—Ed.

Presented in full herewith is the "National Biological and Chemical Warfare Defense Plan" issued under date of October 1959 by the Office of Civil and Defense Mobilization, Executive Office of the President, as Annex 24 to the overall "National Plan for Civil Defense and Defense Mobilization."

The basic National Plan, in its opening section, names three contingencies as those most directly affecting Civil Defense and Defense Mobilization. Titles of these contingencies, and excerpts from the comments thereunder, follow:

A. International Tension

It is assumed that periods of extreme international tension may occur. In such cases, when the President or the Congress finds that the national security demands extraordinary authority for civil defense programs short of declaration of a civil defense emergency, civil defense . . . measures would be accelerated.

B. Limited War

. . . Depending on size of forces involved, duration of hostilities, kinds of weapons used, and degree of U.S. involvement, such limited wars may require . . . acceleration of U.S. non-military defense as a matter of prudence.

C. General War

It is assumed, in the absence of international agreement, that weapons employed in an attack against the U.S. would be predominantly of multimegaton yield. The use of biological and chemical agents is possible . . .

* * *

The basic plan is supplemented by 40 annexes, dealing with specific phases of the problem, all of which are summarized in Annex 41.—Ed.

ANNEX 24

NATIONAL BIOLOGICAL AND CHEMICAL WARFARE DEFENSE PLAN

I. DEFINITION

BIOLOGICAL and chemical warfare (BW and CW) agents are living organisms or their toxic products, or toxic chemicals, capable of causing death or temporary incapacitation to humans, death to animals, and damage to crops. For the purpose of this annex, incendiary agents are excluded.

In the employment of these agents in war, the target is man. He may be affected either directly, by death or disability, or indirectly, by reduction and contamination of his food, drug, and water supply.

Defense against these agents includes measures for their detection, identification, decontamination, and control; warning measures; protection of humans, animals, and crops; and care and treatment of resulting casualties.[1]

II. ASSUMPTIONS[2]

A. The enemy can produce a variety of effective BW and CW agents and can deliver them against the civilian population and agricultural and water resources of the United States by a number of means, overt and covert.

B. BW and CW agents may be used against humans to produce death and illness, impede defensive actions, impair morale, reduce the will to resist, and minimize production capability either for the conduct of war or for recovery and rehabilitation.

C. BW and CW agents may be employed against animals and crops, since long-term recuperative ability may be a decisive factor.

D. BW and CW attacks may precede a nuclear attack sufficiently in advance to impair retaliatory and defensive capability, may accompany an initial nuclear attack, or may follow in subsequent attacks.

E. The effects of BW agent attacks may not immediately be recognized or differentiated from naturally occurring epidemics or from illness produced by radioactive fallout.

F. Adequate preparation in terms of preventive and protective measures, education and training, and provision of treatment measures can greatly minimize the effects of such attacks.

III. GENERAL RESPONSIBILITIES

A. Federal[3]

1. The Director, Office of Civil and Defense Mobilization, will provide the leadership, policy direction, coordination, stimulation, and support necessary for the Nation to make effective preparation for defense against BW and CW agents.
2. The Department of Health, Education, and Welfare, under delegated authority, will develop and direct nationwide programs for the prevention, detection, and identification of human exposure to BW and CW agents, including that from food and drugs.
3. The Department of Agriculture, under delegated authority, will develop a national program for:
   a. Diagnosis and strengthening of defensive barriers and control or eradication of diseases, pests, or chemicals introduced against animals, crops, or products thereof.
   b. Protection of the processing of meats and poultry, and food products thereof.
4. The Department of Defense will furnish OCDM and the delegate Federal agencies with technical information, the results of research and development pertinent to nonmilitary BW and CW defense—giving due consideration to safeguarding security information—and with weather data applicable to BW and CW defense.[4]
5. The Department of Commerce will furnish climatological information applicable to BW and CW defense similar to the fallout prediction data reports now in effect.[5]
6. All Federal agencies are responsible for providing BW and CW protection for personnel at their facilities and for carrying out those BW and CW defense functions assigned to them by statute, delegation, order, and agreement.

[1] See Annex 23, National Radiological Defense Plan.
[2] See Annex 1, Planning Basis.
[3] See Annex 5, Federal Delegations and Assignments.

B. State and Local

State and local governments are responsible for BW and CW defense within their jurisdictions.

1. The State is responsible for evaluating the total situation within its boundaries and contiguous areas, taking necessary protective measures, reporting to the Federal Government, advising the local governments of developments likely to affect their areas, directing the movement of population away from danger areas, and committing State BW and CW defense resources, including those made available by invocation of interstate compacts, as indicated by the situation. States shall also use, where appropriate, resources of nongovernmental organizations. Capabilities excess to the needs of the States shall be reported to the OCDM Regional Director when requested.
2. Local governments are responsible for education and training, advising and warning their populations, reporting the situation to State and contiguous local governments, committing BW and CW defense resources under their control as required by the situation, evaluating their capabilities, and notifying the State as to deficiencies or excess capabilities.

C. Private Organizations and Individuals

1. Individuals are responsible for learning the techniques necessary to minimize the casualty-producing effects of BW and CW, as training programs and information are made available to them. In the event of a BW or CW attack, they shall assist the local BW and CW defense efforts, report diseases and chemical agents, and take recommended protective actions.[6]
2. Industries and organizations—professional, labor, service, religious, civic, and social—are responsible for making such contributions to preparations and performance of BW and CW defense as may be possible.
3. Farmers or livestock owners are responsible for reporting any unusual diseases, insect pests, or unusual losses in their livestock to their veterinarians, the State veterinarian, or the Federal veterinarian in charge, and for reporting plant diseases to the county agent, State entomologist, or the Plant Pest Control leader.

IV. FUNCTIONS

A. Detection, Warning, and Identification

1. Objectives
   a. Early detection of BW or CW attack.
   b. Dissemination of warning to the public and notification of the attack to appropriate government agencies.
   c. Rapid identification of the agent involved, to permit institution of proper preventive and/or treatment measures.
2. Actions Required
   a. Provide necessary equipment and techniques for detection and warning.
   b. Incorporate a BW and CW agent detection capability into other detection, monitoring, and warning systems.[7]
   c. Maintain and expand an epidemiological intelligence capability and awareness at all levels of the civil defense organization.
   d. Maintain and expand a laboratory and diagnostic system and capability for rapid identification of agents at regional, State, and local levels.

B. Individual and Collective Protection

1. Objectives
   a. Physical protection of individuals against exposure to BW or CW agents.
   b. Biological protection against development of disease, by mass immunization and chemoprophylaxis where feasible.
   c. Protection of groups of people from exposure to BW and CW agents.
2. Actions Required
   a. Make individual protective equipment—such as protective masks, infant protectors, and clothing—available to the people through regulated commercial distribution and to civil defense organizational personnel through the Contributions Program and the Federal Loan and Grant Program as well as commercial outlets.[8]
   b. Establish procedures and provide supplies for mass immunization and chemoprophylaxis, as applicable to potential agents.
   c. Incorporate means for preventing entry of BW and CW agents through the ventilating systems and access routes of fallout shelters wherever feasible.[9]
   d. Provide methods, equipment, and supplies for the decontamination of homes, shelters, health facilities, and working areas.
   e. Provide physical or other barriers to sabotage of industry and vital community facilities.[10]
   f. Prevent public access to contaminated areas.[11]

C. Protection of Water Supplies

1. Objective
   To supply water sufficiently free of BW and CW agents for drinking, food preparation, and sanitation purposes.
2. Actions Required
   a. Institute protective measures to minimize contamination of water with BW or CW agents, either incidental to overt attack or by covert introduction.
   b. Provide capability for the detection and identification of contamination.
   c. Provide methods, equipment, and supplies for purification of contaminated water supplies.
   d. Develop and maintain protected sources of water for essential personal uses in an emergency.[12]

D. Protection of Food and Drug Supplies

1. Objective
   To assure that food and drug supplies are free of contamination by BW and CW agents.
2. Actions Required
   a. Institute measures in food and drug industries to prevent or detect introduction of agents.
   b. Decontaminate food and drug packages before opening.
   c. Use preparation methods which will destroy or neutralize contamination.
   d. Carry out emergency salvage operations which will minimize loss of food and drug reserves.[13]

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[4] See Annex 7, Role of the Military.
[5] See Annex 23, National Radiological Defense Plan.
[6] See Annex 2, Individual Action.
[7] See Annex 23, National Radiological Defense Plan.
[8] See Annex 38, Federal Assistance.
[9] See Annex 10, National Shelter Plan.
[10] See Annex 16, Maintenance of Law and Order, and Annex 11, Protection of Essential Facilities.
[11] See Annex 12, Directed Movement.
[12] See Annex 2, Individual Action, and Annex 32, National Water Plan.

E. Insect and Rodent Control

1. Objective

   To minimize the transmission of BW agents by control of the disease-spreading insects and rodents.

2. Actions Required

   Establish procedures and furnish supplies for the control of disease-bearing insects and rodents.

F. Casualty Care

1. Objective

   Adequate treatment and care of people affected by BW or CW agents.

2. Actions Required

   a. Accumulate and locate for ready distribution stocks of essential biologics, chemotherapeutic material, and equipment estimated to be in short supply for the treatment of BW and CW casualties.

   b. Orient medical personnel in diagnosis, treatment, and care of BW and CW casualties.

   c. Develop maximum capability for self, home, and group care on the part of the general population.

G. Prevention, Control, and Eradication of Animal Diseases, Plant Diseases, and Harmful Insects

1. Objectives

   a. To minimize clandestine introduction of insect pests or diseases of animals or crops which could cause epidemics of serious proportion even before sabotage is suspected.

   b. To minimize the effects and control the spread of insect pests or diseases of animals or crops which could cause epidemics.

2. Actions Required

   a. Maintain quarantines and import restrictions to prevent insofar as possible the entrance of foreign diseases and insect pests into the country and their spread from localized areas within the country.

   b. Maintain and expand services for prompt detection, diagnosis, and reporting of dangerous animal diseases.

   c. Conduct surveys to find plant diseases and insects before they become widely or perhaps permanently established.

   d. Develop control measures for the specific diseases and pests anticipated as biological warfare agents.

   e. Develop eradication procedures.

H. Information and Education[14]

1. Objectives

   a. To develop an appreciation of the potential hazards of biological and chemical warfare on the part of the general population, industry, and all levels of government so as to demonstrate the need for adequate protection, detection, prevention, and decontamination measures.

   b. To insure support of governmental programs regarding such defense and to stimulate appropriate and effective public action.

   c. To inform the public about the effective use and limitations of available protective measures and to secure cooperation in the control of the spread of infections.

   d. To prevent hysteria and unwise mass action.

2. Actions Required

   a. Expand civil defense programs of information and education through all appropriate media, to disseminate information regarding the need for protection and preparation against the use of BW and CW agents.

   b. Prepare and revise as necessary informational and instructional material on the following broad subjects:

      (1) The importance of individual preparedness against BW and CW attack in the total national security program.

      (2) Effects of BW and CW agents on people, food, drugs, plants, and animals.

      (3) How to provide protection, including:

         (a) Use of specialized protective equipment.

         (b) Incorporation of protective measures in home and basement shelters, on farms and ranches, and in food and biological industries.

         (c) Use of emergency expedients in protection.

         (d) Measures for protection of food, drugs, and water.

         (e) Immunization.

         (f) Decontamination of homes and other environmental areas.

         (g) Recognition of casualties and home or group care of casualties.

      (4) Current programs of Federal, State, and local governments relating to BW and CW protection.

I. Training[15]

1. Objectives

   a. To enable governments at all levels to attain operational readiness for effective BW and CW defense.

   b. To enable the general public to know the measures to be taken for their protection.

2. Actions Required

   a. Inform and train government leadership at all levels in the concepts, problems, and techniques of BW and CW defense.

   b. Train public health, agricultural, and food and drug personnel in the technical aspects of their functions in BW and CW defense.

   c. Train medical, veterinarian, and related personnel in preventive measures and in diagnosis, treatment, and care of BW and CW casualties.

   d. Train civil defense operational personnel in detection, monitoring, and decontamination of BW and CW agents.

   e. Train members of the food and drug industries in BW and CW detection, monitoring, and decontamination.

   f. Train the general public in BW and CW protective measures.

J. Research and Development[16]

1. Objective

   To assure necessary technical information, specialized equipment, and methods to permit execution of the above functions.

2. Actions Required

   a. Establish mechanisms to insure coordination of military and nonmilitary research for effective interchange and utilization of information.

   b. Devise practical methods and devices for rapid monitoring, detection, warning, and identification of agents.

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[13] See Annex 31, National Food Plan.

[14] See Annex 9, Public Information.

[15] See Annex 37, Training and Education.

[16] See Annex 36, Research and Development.

c. Develop individual protective equipment.

d. Develop the necessary materials, equipment, and designs for BW and CW protection in family and group shelters.

e. Develop emergency expedients for use by people who, at the time of an attack, lack the recommended protective equipment and who are unable to reach a safe shelter area.

f. Study effects of chemical and biological weapons on humans, foods and drugs, animals, and plants, through the biophysical, biochemical, and medical sciences, with emphasis on improving:

(1) Preventive, prophylactic, and therapeutic measures.

(2) Psychologic measures.

(3) Emergency casualty and medical care.

(4) Use of health resources.

(5) Emergency sanitation.

(6) Decontamination procedures.

g. Develop methods of decontamination of homes, shelters, hospitals, and other environmental areas.

h. Improve methods for removal or neutralization of agents in food, drugs, water, and other supplies essential for survival.

i. Conduct operational research to evaluate concepts of BW and CW defense and to determine optimum organizational procedures and techniques for defense against the agents.

j. Investigate and experiment with destructive foreign insects and on plant and animal diseases.

k. Develop survey-type methods to find plant diseases and disease-carrying insects before they become widely or permanently established.

V. EXECUTION

A. Office of Civil and Defense Mobilization

Actions taken under the National Biological and Chemical Warfare Defense Plan shall be coordinated and directed by the Director, Office of Civil and Defense Mobilization, as measures essential for the protection of life and property in accordance with Part IV, Section A; and Part V, Section I, Subsection 3, of the National Plan. OCDM shall:

1. Acquire and store limited quantities of BW and CW defense supplies and equipment as a general reserve.
2. Allocate chemical and biological defense and decontamination equipment to Federal agencies as required and to State and local governments under provisions of the loan and grant or transfer programs and match funds for procurement under the Federal Contributions Program.
3. Provide financial assistance to the States and their political subdivisions for the recruitment and training of BW and CW defense personnel.
4. Encourage the development and manufacture of individual chemical and biological defense equipment for sale to private citizens through commercial outlets.

B. Department of Defense

The Department of Defense shall provide OCDM and the delegate Federal agencies with technical information, the results of research and development pertinent to nonmilitary BW and CW defense—giving due consideration to safeguarding security information—particularly in those areas developed by the military medical services and by the Army Chemical Corps. It shall also, within its capabilities, make available data which is applicable and required for BW and CW defense monitoring.

C. Department of Commerce

The Department of Commerce shall provide forecasts of likely effects of the weather on the distribution of BW and CW agents, establish chemical and biological warfare monitoring and reporting capabilities at the Weather Bureau Observatories, and assist in the testing of detection equipment.

D. Department of Agriculture

The Department of Agriculture shall develop plans for a national program for the direction of Federal activities and furnish technical guidance to State and local authorities concerned with (a) diagnosis and strengthening of defensive barriers and control or eradication of diseases, pests, or chemicals introduced as agents of biological or chemical warfare against animals, crops, or products thereof, and (b) protection of the processing of meats and poultry, and food products thereof, to assure their safety and wholesomeness and minimize losses from biological and chemical warfare effects. The Agricultural Research Service is the agency which will discharge the responsibility of carrying out the Federal program for the Department of Agriculture and will use emergency Federal powers contained in the civil defense statutes.

1. The Agricultural Research Service conducts fundamental and applied research and demonstrations relating to the production and utilization of agricultural products, and conducts those controls and regulatory programs of the Department of Agriculture which involve enforcement of plant and animal quarantines, the control and eradication of diseases and insect pests of animals and plants, meat inspection, and related work. It carries out as well the physical, chemical, and biological science research for the Department of Agriculture.

a. Farm research programs of this Service include the soil-water-plant relationship, conservation, and management; crop and animal research of the diseases that affect domestic animals and poultry; and the study of methods of controlling or eradicating insects that are injurious to farm products, including support of cooperative Federal-State insect control and quarantine activities.

b. The regulatory programs of this Service concern themselves with a meat inspection service to insure the wholesomeness of domestic and imported meat and meat products; animal diseases and their eradication; inspection and quarantine of animals and animal products of foreign origin; plant pest control; and quarantining of imported plants and plant products. The Agricultural Research Service maintains and operates research and diagnostic laboratories in various parts of the United States. It cooperates with the States on disease control and eradication through its established State-Federal cooperative disease and insect control programs.

E. Department of Health, Education, and Welfare

The Department of Health, Education, and Welfare shall develop and direct nationwide programs for the prevention, detection, and identification of human exposure to BW and CW agents and shall conduct research, establish standards, and provide technical advice, consultation, and guidance to Federal, State, and local authorities concerned with (a) diagnosis, strengthening of protective measures, control, or eradication of diseases, pests, or chemicals introduced as agents of biological or chemical warfare against humans, whether such agents are introduced into the air, water, food, biological products, or drugs, and (b) protection of the

processing and distribution of food, food products, drugs, and biological products to assure their safety and wholesomeness and to minimize losses from biological and chemical warfare effects. DHEW executes its responsibilties in this field through two of its operating Agencies, the Public Health Service and the Food and Drug Administration; 10 regional offices; and 17 FDA district offices.

1. The Public Health Service is the Federal agency specifically charged by law with the responsibility for protecting and improving the health of the people of the Nation. It assists the States and their political subdivisions in establishing and maintaining effective programs for the prevention, treatment, and control of disease and for the maintenance of health. The Public Health Service is concerned with the safety of biological products, with pollutants of air and water, and with the eradication and control of diseases communicated from man to man, from animals to man, and from pests to man. The Service maintains domestic and foreign quarantine programs, an air sampling network, and a water pollution control program, and provides technical assistance to States in the development and maintenance of effective milk, shellfish, and restaurant sanitation programs.
2. The Food and Drug Administration is the principal Federal agency having responsibility for protection of the safety and wholesomeness of the interstate supply of foods and drugs, assuring that these are free of contamination by BW and CW agents. It works closely with each of the States and local food and drug enforcement officials, who are closely related through the Association of Food and Drug Officials of the United States, and with other Federal departments and agencies.

F. State and Local Governments

Execution of the chemical and biological defense responsibilities of State and local governments, private organizations, and individuals shall be in accordance with Part IV, Section B; and Part V, Section I, Subsection 3, of the National Plan.

1. The regular animal and crop protection services maintained by State and local agricultural agencies will integrate their operations with the Department of Agriculture as follows:
   a. The State livestock sanitary official, conducting the animal diseases control program within his State by means of his own organization in collaboration with the Animal Disease Eradication Division, Agricultural Research Service, USDA, and with the veterinary practitioners of the State.
   b. A State-Federal Emergency Animal Disease Eradication Organization established in each State, assigning specialists to handle specific responsibilities in the event that biological warfare is used on the livestock of the country.
   c. State plant regulatory officials and the State plant pest-control supervisors, coordinating activities in these areas in each State.
   d. County agents, screening farmers' reports of unusual disease outbreaks or insect infestations and informing the State officials designated above.
2. The regular health protection services maintained by State and local governments will integrate their operations with DHEW as follows:
   a. State health departments conducting the disease control program within the States will collaborate with the Public Health Service and Food and Drug representatives in the appropriate DHEW regional office and with the professional organizations in the State.
   b. State departments of agriculture which have responsibilities for controlling the quality and purity of fluid milk, food, and drugs will collaborate with the PHS and FDA representatives in the appropriate DHEW regional offices.
   c. Other State agencies having health-related responsibilities will collaborate with the State health departments and with the PHS and FDA representatives in the appropriate DHEW regional offices.
   d. Local and county health departments and other agencies with health-related activities will coordinate their programs with the State agencies, and through the State agencies with the Public Health Service and the Food and Drug Administration.

ALL NEW BUILDINGS SHOULD HAVE SHELTERS, SAYS HOEGH

The Office of Civil and Defense Mobilization urges State and local governments, industry, business and intitutions to incorporate fallout shelters in any new buildings.

In OCDM Advisory Bulletin No. 243, Civil and Defense Mobilization Director Leo A. Hoegh pointed out that the National Shelter Policy directs the Federal Government to provide fallout shelters in appropriate new buildings designed for civilian use. He urged officials of State and local governments and leaders of business and industry to take similar action.

AFRICAN WITCHWEED SCARE BRINGS OUT ARMY DECONTAMINATION TEAMS

The Army and the Department of Agriculture recently joined forces in a "war against witchweed" near Nichols, South Carolina. The Army's "brush" with witchweed came when a caravan of 350 Army vehicles participating in Exercise DRAGON HEAD unknowingly violated an infected area. Witchweed is a plant parasite indigenous to South Africa that attacks the root systems of crops such as corn, rice, and sugar cane, and hampers their growth and development.

The discovery of witchweed in areas of North and South Carolina in 1956 resulted in Federal and State quarantines to bring it under control. Fearing the contaminated Army vehicles would spread the parasite and jeopardize the lengthy control program, military authorities were notified of the situation. Spray teams from the USDA Plant and Pest Control Division were joined by trained chemical-biological-radiological decontamination teams from the 82nd Airborne Division and Fort Bragg, N. C., in decontaminating vehicles.

The unscheduled decontamination exercise tested the ability of U. S. Army Chemical Corps and USDA decontamination teams to cope with an actual field situation. Within hours the 82nd Airborne Division organic decontamination units and USDA spray units started decontaminating the vehicles, with additional decontamination units and their equipment on the way from Third U. S. Army and XVIII units at Fort Bragg. The operation revealed the speed and competence with which Army and USDA decontamination units could accomplish their mission in the event of chemical, biological, or radiological warfare.

WITH THE CHEMICAL CORPS

JOINT U.S.-CANADA MEETING ON ENVIRONMENTAL TESTING

Major Gerald A. Corwin, Chief of Environmental Test at Dugway Proving Ground, presented a paper on "The United States Army Chemical Corps Environmental Research Program," at the "Joint United States and Canadian Meeting on Environmental Research," held at Ottawa, Canada, the week of October 21-23.

Mr. George J. Cabrey, Chief of Technical Operations at Dugway, also attended the meeting, which was the first of its kind to be held.

In addition to the testing at Dugway, the Chemical Corps program is supported by additional test sites in the Canal Zone, Panama; Yuma, Arizona; Fort Greely, Alaska; and Polar Ice Cap. All of the facilities are under the direction of Dugway.

NEW TRAINING DIVISION AT SCHOOL

A new division, the Replacement Training Division, has been incorporated into the U.S. Army Chemical Corps School. Headed by Lt. Colonel Joseph R. Pickett, the new division prepares and presents instruction to selected enlisted personnel in basic aspects of chemical, biological, and radiological warfare.

Enlisted men, who have completed their basic training, are instructed in their advanced individual training by this Division.

GEN. ESSMAN SPEAKS AT SCHOOL

"There will be an increased need for well-trained Chemical Corps officers," predicted Brigadier General Graydon C. Essman, Commanding General of the U.S. Army Chemical Corps Research and Development Command, Washington, D.C., speaking at the opening exercises last September of the Fourteenth Chemical Officers Advanced Class at the U.S. Army Chemical Corps School.

General Essman commended to the student officers four virtues emphasized by Plato: Prudence, Fortitude, Temperance, and Justice. "Make these virtues habits," he advised. "They will be of much aid to you in your military career."

ADVANCED NCO CLASS HELD

FT. McCLELLAN, ALA.—Closing exercises for the First Advanced Non-Commissioned Officers (Staff Specialist) Course were held in Coughlan Auditorium, U.S. Army Chemical Corps School on 23 October 1959.

Col. William H. Greene, Commandant, Chemical Corps School, introduced the guest speaker, Col. John M. Palmer, Commanding Officer, Chemical Corps Training Command. Colonel Palmer, who was an enlisted man himself, emphasized the respected position of NCO's in general and stated that in the near future these men with this added training would probably be holding top positions.

MILLY GIVEN STUDY FELLOWSHIP

EDGEWOOD, MD. — Mr. George Milly, senior physical scientist of the Operations Research Group here has been given a Secretary of the Army research and study fellowship.

A graduate of Niagara College, Mr. Milly received the grant to study at the University of Michigan meterological influences on disease.

Before joining the Army as a civilian researcher in 1947, Mr. Milly was employed by Armour & Company as a research biochemist in the pharmaceutical branch.

Mr. Milly has written more than 70 scientific papers concerning his work here at Army Chemical Center. One of these won him a certificate of achievement at the Army Scientific Conference held at West Point in June.

SMOKE GENERATOR IN ACTION

FORT BENNING, GA.—SP4 (Specialist Fourth Class) George Williams of Martin, S.C., operates a smoke generator at the Infantry School, Fort Benning, Georgia, for concealment purposes in troop training exercises. SP Williams is with the 183rd Chemical Platoon, 14th Infantry, Second Battle Group.

'BAMA STUDENTS VISIT McCLELLAN

In a planned visit, a group of University of Alabama students, acting in their capacity as student affiliates of the American Chemical Society, toured the classroom

and laboratory facilities of the U.S. Army Chemical Corps School last October.

At Unmacht Field, after seeing the various types of chemical munitions and equipment, they were taken to a Chemical Corps School classroom where Capt. Edwin A. Stovall, instructor, displayed training and classroom aids.

The visitors then proceeded to the biological, chemical, radiological laboratories.

The visiting groups included Ann Rodgers, Estelle Gardner, Weldon Matthews, Kennedy Smith, Robert Brown, Howard Hinderer, Ronnie Dykes, and Mary Ann Higgs, students. They were accompanied by Dr. Robert Garner, faculty member.

DR. HAROLD S. KING RETIRES

EDGEWOOD, MD.—Dr. Harold S. King, a leader in chemical warfare research since the early days of World War I, retired from Army Chemical Center last October to devote full time to daffodil breeding and research.

A founder and director of the American Daffodil Society, Dr. King expects to breed new strains of daffodils on his 15-acre farm near Darlington. He is also chairman of the 1200-member society's health and culture committee.

Dr. King had been assigned to the Chemical Corps Board here since 1946.

RECEIVES BRAZILIAN MEDAL

MARSHAL HENRIQUE LOTT, (left) Brazilian Minister of War, presents the Medalha de Pacificador to Lieutenant Colonel Albert B. Del Monte, commander of Army Chemical Center's Technical Escort Unit. The Brazilian medal was awarded to Colonel Del Monte for his services as escort and interpreter for Marshal Lott during his recent five-day tour of the United States.

ORGANIZATION DAY OF 100TH CHEMICAL GROUP

2 October 1959 was "Organization Day" for the 1300 officers and men of Fort McClellan's 100th Chemical Group.

Organization Day commemorated the many accomplishments and successful battle engagements that have marked the unit's history.

The day's festivities and ceremonies consisted of a review led by the Group's non-commissioned officers, an equipment display by the Group's three battalions, religious services held at Centurion Chapel, and evening social events.

Colonel Carl W. Bartling, commanding officer of the 100th Chemical Group, reviewed the parade with his staff.

In the Ceremonial Review the troops were commanded by M/Sgt. Ralph Windom, Sergeant Major of the 100th Group. Commanding the battalions for the parade were M/Sgt. Walter Myers, 1st Battalion; M/Sgt. Ollie J. Thomas, 83 Battalion; and M/Sgt. Arthur B. Lau, 218th Battalion—all top NCO's of their respective battalions.

After the parade the three battalions displayed major items of equipment, and, also highlighting the day's activities, was a noon meal at the company's messhalls, to which wives and children of the Group personnel were invited.

Colonel Bartling's 1300-man command is the largest troop unit in the Chemical Corps, and has a tradition of battle service dating from the famous 1st Gas Regiment of World War I.

The Group has been assigned as a subordinate element of the Training Command since July 1952 and is presently organized for furnishing smoke, depot, processing, decontamination, and combat support operations needed in field army or communications zone.

Colonel Bartling served in five European campaigns in World War II, and in Korea for three years as the Chemical Advisor for the Republic of Korea Army.

In charge of command parade ceremony, Lt. Col. Elvin Dalton (back to camera), Commanding Officer, 100th Cml. Gp, turns over the command to Colonel Carl W. Bartling, the new commanding officer. Picture taken at ceremony last July.

6TH ANNIVERSARY OF SCHOOL SUPPORT BATTALION OBSERVED

The 6th anniversary of a military unit, organized, and trained at Fort McClellan, was celebrated on 17 October 1959.

This unit—The U.S. Army Chemical Corps School Support Battalion—was organized during October of 1953 as the Chemical Corps Training Support Group, with the mission of providing administrative and logistical support to the Chemical Corps School. In 1957, the Battalion received its present designation.

M/Sgt. William T. Whitaker, Sgt. Major of the Battalion, cut the birthday cake at the celebration in the presence of the Battalion's commanding officer, Major Fred C. Drewery. Guests included Colonel John M. Palmer, commanding officer, U.S. Army Chemical Corps Training Command, and Colonel William H. Greene, commandant, Chemical Corps School.

RESEARCH LEAVE FOR DR. CLEMENTS

ARMY CHEMICAL CENTER, MD.—Dr. John A. Clements, lung research specialist in the Chemical Warfare Laboratories here, began a leave of absence on August 15 to serve a year as a member of the staff of the University of California's Cardiovascular Research Institute in San Francisco.

The Institute extended the invitation primarily because of Dr. Clements' pioneering research work on a lung lining that affects breathing. The research was conducted to help develop better medical treatments for chemical warfare casualties. His work is of special interest to other scientists who are studying asphyxia of the newborn, a sickness that kills about 25,000 infants in this country each year.

NEW DETRICK COMMANDER

Colonel Laverne A. Parks on December 4, 1959 assumed command of Fort Detrick, Maryland, where the Chemical Corps' biological warfare laboratories are located. Colonel Parks' last previous assignment was as Assistant Commandant of the Chemical Corps School, at Fort McClellan, Ala.

Colonel Parks has a degree in chemistry from the University of Michigan and has a Master's degree in business administration from the University of Pennsylvania.

During the 1944-45 period in World War II he served as chemical officer of the 96th Division in the Pacific; was awarded the Bronze Star Medal and the Purple Heart.

COLONEL WALTER P. BURN

Colonel Walter P. Burn, who served in the Chemical Warfare Service during World War II and who was also a veteran of World War I, died of a heart ailment at Middlebury, Vermont, on Friday, December 4, 1959.

Burial services were held at the Fort Myer Chapel, at Arlington National Cemetery.

Colonel Burn served in the Office of the Chief of Chemical Warfare Service in Washington during the early part of World War II. Later he was attached to the Office of Civilian Defense in charge of training. Subsequently he was assigned as chemical officer of the Second Corps and participated in operations in North Africa and Italy. Between wars Colonel Burn was engaged as an advertising executive.

FT. DETRICK WINS ARMY SAFETY AWARD FOR 1959

Fort Detrick won the U. S. Army Chemical Corps Award of Honor for Safety for the fiscal year 1959, and received the official plaque from Brigadier General Graydon C. Essman, commanding general, R&D command.

This award was for the best safety performance record of the year, whereas, the A.F.C.A. Safety Award plaque presented to Pine Bluff Arsenal at the annual meeting last September was for the best 3-year average.

NEW SCHOOL COMMANDANT

Colonel William H. Greene, the new Commandant of the U. S. Army Chemical Corps School, at Fort McClellan, Alabama, is a graduate of Harvard College, also the Army War College, Army Command & General Staff College and the Chemical Corps School.

Colonel Greene, in his new assignment, replaced Colonel Carl V. Burke, who, in turn replaced Col. Greene in his last previous post as Chemical Officer, Headquarters Pacific, Hawaii.

Colonel Greene served as Corps Chemical Officer in the Third Army in Europe in World War II, and, since the war, among his other assignments, as Commanding Officer of Pine Bluff Arsenal.

His military career began with an enlistment in the Massachusetts National Guard in 1929. In 1934 he was commissioned in the Guard, and in 1941 he was called to active duty. He was integrated in the Regular Army in 1947.

AWARDS

THE JOURNAL is pleased to present here information received as to recent official Army awards made to personnel of the Chemical Corps:

THIRTY YEARS SERVICE

Mr. Neal N. Read, Chief, Hqrs. Opns., Section, Personnel Division, O.C.Cml.O., Washington, D. C., receiving award from Major General Marshall Stubbs, Chief Chemical Officer.

Certificates of Achievement for:

Thirty Years Service .....Neal H. Read
Twenty Years Service ....Eleanor A. Horn; Mary B. Roberts; Paul G. Bihlman;

M. Allen Bost; Mason S. Cartmell; Edgar A. Crumb; and Frederick G. Muller

Ten Years Service .... Dr. Gordon L. Bushey, Ruth V. Cochran, G. Landon Feazell, Martha L. Freeman, Jeanette L. Ott, and Francis J. Sullivan

Outstanding Performance Appraisal:
Mr. Forrest C. Hall

Sustained Superior Performance:
Mrs. Barbara E. Gleason (N. Y. Army Cml. Procurement District)
Josephine Chase (Office of Chief Cml. Officer)
Eleanor A. Horn (Office of Chief Cml. Officer)

SPECIAL ISSUE OF "GAS ATTACK" FOR REUNION OF 1ST GAS REGT.

THE JOURNAL was pleased to receive a copy of the special souvenir issue of "Gas Attack," the quarterly publication of the 1st Gas Regiment.

This unique organization of World War I veterans held their 40th annual reunion meeting at the Army Chemical Center.

The special issue of the magazine, which was issued last May, dealt with this reunion, attended by some 200 members and wives. Both Major General Marshall Stubbs, Chief Chemical Officer, and Brigadier General Harold Walmsley (now retired), the then Post Commander, were present at the celebration.

The publisher of "Gas Attack" is Mr. Ed Carter, and the editorial offices are at 5707 W. Lake Street, Chicago 44, Illinois.

PHILOSOPHIC REFLECTIONS ON RACKS FOR GAS MASKS

FORT ORD, CALIF.—Not long ago, a story appeared in the Fort Ord "Panorama" concerning a home-made gas mask rack in Headquarters Company, 7th Battle Group, 3d Brigade. It now appears that the article had far-reaching effects among do-it-yourself gas mask rack builders. In fact it might be said that one group in particular felt quite indignant about the fact that its rack wasn't even mentioned.

The 33d Transportation Company (Light Helicopter), feels that not just every rack deserves a story, but at least the public should get a chance to see their version and "think for himself."

"After seeing the article on the gas mask rack," stated Specialist Fifth Class Marvin H. Wright, designer and builder of the 33d's rack, "we felt that we should get a chance to show our method of storing the masks."

Wright joined the supply section as a clerk six months ago. He approached First Lieutenant Norman E. Stockton, the supply officer, and Sergeant First Class Jeffrie B. Drew, the supply sergeant, with his plan for the rack. Assisted by Specialist Fourth Class Evangelos P. Espanopoulus and Private First Class Robert E. Gottreu, he completed the project three weeks later.

Basically the 33d's rack is of the lazy susan design. It occupies a space seven-and-one-half feet high and four feet wide. Circular in shape, the rack was built from 5/8 inch plywood, salvaged 57mm recoilless rifle parts, and surplus jeep hubs. The total cost for the construction was $23, for the plywood and hooks.

The rack is on casters and can be moved easily. It can be dismantled in 10 minutes to form a rolling stack of discs 10 inches high, with the metal pieces fitting into foot lockers.

Servicing two companies, the 33d and the 573d Transportation Detachment, it holds 202 masks. Yellow numerals on the black-edged discs identify masks for the 573d, while white numbers are for the 33d.

Maintenance is simple—only dusting is required.

Commenting on the advantage of this rack, Sergeant Drew said: "Ours is easily dismantled and moved rapidly, a great help. Also, since we have not used any tin cans like most of the other rack-makers, the chance of getting cut is eliminated."

Wright, when asked: "Do you think that everyone should build this kind of a gas mask rack?" replied "Well, I believe that everyone should think for himself. But who knows, maybe this is the thinking man's gas mask rack."

FORT ORD, CALIF.—Even issuing gas masks to a dog is easy with this storage rack. The rack's designer and builder, Specialist Fifth Class Marvin H. Wright, gives the "lazy susan" a spin until Princess' mask comes up.

THE HISTORICAL CORNER

By Dr. Brooks E. Kleber
Historical Office, Chemical Corps

THE 78TH DIVISION USES GAS IN THE MEUSE-ARGONNE

"Gas Warfare in World War I" is the title of a series of documents being prepared under the direction of the U.S. Army Chemical Corps Historical Office. Surprisingly enough, very little has been done in the exploration of this field. The merits of the program are obvious—World War I was the only large scale conflict which saw the employment of gas warfare. To be sure, times have changed. The agents and means of delivery available today far out-distance their counterparts of World War I yet certain constants remain. One of the greatest lessons to be garnered from the battles of the first World War is the reaction of the soldier when first encountering gas. The interrelation of training and gas discipline have a continuity which defies changes and improvements in the weapons. Also, certain tactical concepts maintain their validity. The following brief episode considers a tactical lesson.

Early in September 1918 Marshal Foch announced his plan for an offensive against the Germans which would encompass the entire front. The U.S. First Army, with the Fourth French Army and the XVII French Corps, struck the first blow of what Foch called "the greatest of all battles." The battleground was the Meuse-Argonne sector; the goal was the seizure of Sedan and Mezieres and the consequent breach in enemy lateral communications. Because the Germans had augmented the rugged terrain of the Argonne Forest by a series of defensive positions the American and French forces in that area faced a formidable task.

The attack began on 26 September against stubborn resistance. The three corps of the U.S. First Army were stopped by the strong defenses of Kriemhilde Stellung and remained thwarted despite renewed efforts in October. The Allies had made relatively little use of gas during these operations with the exception of heavy mustard attacks on heights of the Meuse east of the river, in the sector of the XVII French Corps.

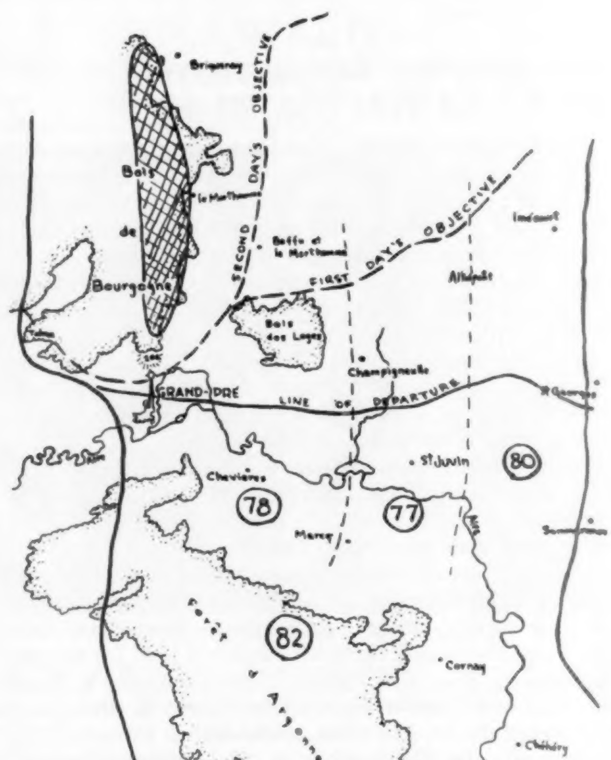
On 1 November the First Army renewed its attack against the Kriemhilde position. One of the strongest points in the German line lay in front of the 78th U.S. Division, on the left of I Corps. The keys to this sector were two large woods, the Bois de Bourgogne and the Bois des Loges (see map). Both bristled with machine gun positions closely supported by field artillery.

The artillery preparation for attack of the 78th Division began on 30 October, directed primarily against the Bois de Bourgogne and the Bois des Loges. The division's light artillery fired mustard gas at all known battery positions in the Bois de Bourgogne, expending almost 30,000 rounds during a 12-hour period. Early the next morning corps artillery contributed 400 105-mm. shells, making a total of over 41 tons of mustard fired against the woods. Against the smaller Bois des Loges on the division's right no gas was used, but an estimated 12,625 75-mm. HE, 3,000 155-mm. HE, and 650 phosphorus shells were fired.

Despite this extensive HE preparation against the Bois des Loges, the attacking American troops encountered an undaunted enemy. Captured prisoners reported that losses from the bombardment were slight. The situation in the Bois de Borgogne where gas had been used was striking and different. There the enemy defenses had been completely neutralized and the troops advanced without enemy resistance from the mustardized area. This woods had been occupied almost exclusively by enemy machine gun units protecting the guns of the German **76th Reserve Division.** Enemy reports revealed the effectiveness of the gas attack. Seven of nine batteries of the division **Near Bombardment Group** were put out of action, and two regimental headquarters had to be abandoned. By the night of 31 October the **76th Reserve Division** suffered 210 gas casualties.

Having swept by the Bois de Bourgogne American troops in that sector prepared to strike at the enemy in the Bois des Loges, only to find the attack unnecessary. The Germans, their position made untenable by the loss of the Bois de Bourgogne, had withdrawn to the north, as part of the general consolidation of enemy lines in the days just prior to the Armistice.*

* The World War I episode is based on the draft manuscript "The Use of Gas in the Meuse-Argonne Campaign," one of the series "U.S. Army Chemical Corps Historical Studies: Gas Warfare in World War I" written by Dr. Rexmond C. Cochrane, under the direction of the U.S. Army Chemical Corps Historical Office.



GROUP AND SUSTAINING MEMBERS

OF THE ARMED FORCES CHEMICAL ASSOCIATION

Abbott Laboratories, North Chicago, Ill.

Adache Associates, Inc., Engineers, Cleveland, Ohio

Air Reduction Company, Inc., New York, N.Y.

Allied Chemical Corporation, New York, N.Y.

American Cyanamid Company, New York, N.Y.

American Potash & Chemical Corporation, 300 West Sixth, St., Los Angeles 54, California

American Zinc, Lead & Smelting Co., St. Louis, Mo.

Armour & Company, Chicago, Ill.

Armstrong Cork Company, Lancaster, Pa.

Astra Pharmaceutical Products, Inc., Worcester 6, Mass.

Atlas Powder Company, Wilmington, Del.

Barnebey-Cheney Company, Columbus, Ohio

Bechtel Corporation, San Francisco, Calif.

Bell & Gossett Company, Morton Grove, Ill.

Blaw-Knox Company, Pittsburgh, Pa.

Brothers Chemical Company, 575 Forest St., Orange, N.J.

Brown Company, Berlin, N.H.

Casco Products Corporation, Bridgeport, Conn.

Celanese Corporation of America, New York, N.Y.

City Chemical Corp., New York, N.Y.

Columbia-Southern Chemical Corp., Pittsburgh, Pa.

Commercial Solvents Corporation, New York 16, N.Y.

Continental Oil Co., Ponca City, Okla.

Crane Co., Chicago, Ill.

Diamond Alkali Company, Cleveland, Ohio

Dow Chemical Company, Midland, Mich.

E. I. duPont de Nemours & Co., Inc., Wilmington, Del.

Edo Corporation, College Point, N.Y.

Engelhard Industries, Newark, N.J.

Esso Research and Engineering Co., New York, N.Y.

Evans Research & Development Corp., New York, N.Y.

Federal Laboratories, Inc., Saltsburg, Pa.

Ferguson, H. K., Company, The, Cleveland, Ohio

Ferro Corporation, Cleveland, Ohio

Firestone Industrial Products Co., Fall River, Mass.

Fisher Price Toys, Inc., East Aurora, N.Y.

Fisher Scientific Co., New York, N.Y.

Fluor Corporation, Ltd., The, Whittier, Calif.

Food Machinery & Chemical Corporation, New York, N.Y.

Foster Wheeler Corporation, New York, N.Y.

Fraser & Johnston Co., San Francisco, Calif.

General Aniline & Film Corporation, New York, N.Y.

General Electric Company, Chemical & Metallurgical Division, Pittsfield, Mass.

General Tire & Rubber Company, The, Wabash, Ind.

Goodrich, B. F., Chemical Company, Cleveland, Ohio

Harshaw Chemical Company, The, Cleveland, Ohio

Harvey Aluminum, Torrance, Calif.

Hercules Powder Company, Wilmington, Del.

Heyden Newport Chemical Corporation, New York, N.Y.

Hooker Chemical Corporation, Niagara Falls, N.Y.

Industrial Rubber Goods Company, St. Joseph, Mich.

International Nickel Co., Inc., New York, N.Y.

International Salt Co., Inc., Scranton, Pa.

Kennecott Copper Corporation, New York, N.Y.

Koppers Company, Inc., Pittsburgh, Pa.

Lambert-Hudnut Mfg., Laboratories, Inc., Lititz, Penna. subsidiary of Warner-Lambert Pharmaceutical Company, St. Louis, Mo.

Eli Lilly and Co., Indianapolis 6, Ind.

Little, Arthur D., Inc., Cambridge, Mass.

Lummus Company, The, 385 Madison Ave., New York, 17, N.Y.

Mason, L. E., Company, Hyde Park, Mass.

Merck & Company, Inc., Rahway, N.J.

Mine Safety Appliances Co., Pittsburgh, Pa.

Minnesota Mining & Manufacturing Co., 900 Fauquier Avenue, St. Paul, Minnesota

Miracle Adhesives, Corp., 250 Pettit Ave., Bellmore, Long Island.

Monsanto Chemical Company, St. Louis, Mo.

National Cylinder Gas Co.—Chemical Div., Chicago 11, Ill.

Niagara Blower Co., New York, N.Y.

Olin Mathieson Chemical Corp., East Alton, Ill.

Oronite Chemical Company, San Francisco, Calif.

Pemco Corporation, Baltimore, Md.

Pennsalt Chemicals Corporation, Philadelphia, Pa.

Pfizer, Chas. & Company, Inc., Brooklyn, N.Y.

Pfaudler Company, a Division of Pfaudler Permutit, Inc., Rochester 3, New York

Phillips Petroleum Company, Bartlesville, Okla.

Pittsburgh Coke & Chemical Co., Pittsburgh, Pa.

Procter & Gamble, Cincinnati, Ohio.

Reynolds Metals Company, Louisville 1, Ky.

Shell Chemical Corp., Denver, Colo.

Shell Development Company, Emeryville, Calif.

Sheller Mfg. Co., Dryden Rubber Div., Chicago, Ill.

Shwayder Bros., Inc., Denver, Colo.

Standard Oil Company (Indiana), Chicago, Ill.

Stauffer Chemical Company, New York, N.Y.

Sun Oil Company, Philadelphia, Pa.

Union Carbide Corporation, New York, N.Y.

United-Carr Fastener Corp., Cambridge, Mass.

Universal Match Corp., Ferguson, Mo.

United States Borax & Chemical Corp., 630 Shatto Place, Los Angeles 5, Calif.

Vitro Corporation of America, New York, N.Y.

Vulcan-Cincinnati, Inc., 120 Sycamore St., Cincinnati 2, Ohio

Wigton-Abbott Corporation, 1225 South Avenue, Plainfield, N.J.

Witco Chemical Company, Chicago, Ill.

Wyandotte Chemicals Corp., Wyandotte, Mich.

Companies listed in bold face type are Sustaining Members